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Hydraulic Portable Riveting Machines.

The Niles Tool Works Co., of Hamilton, Ohio, with Eastern branch at 136 and 138 Liberty street, New York, have brought out a large class of hydraulic portable riveting machines, of which we give some illustrations on this and the succeeding page.

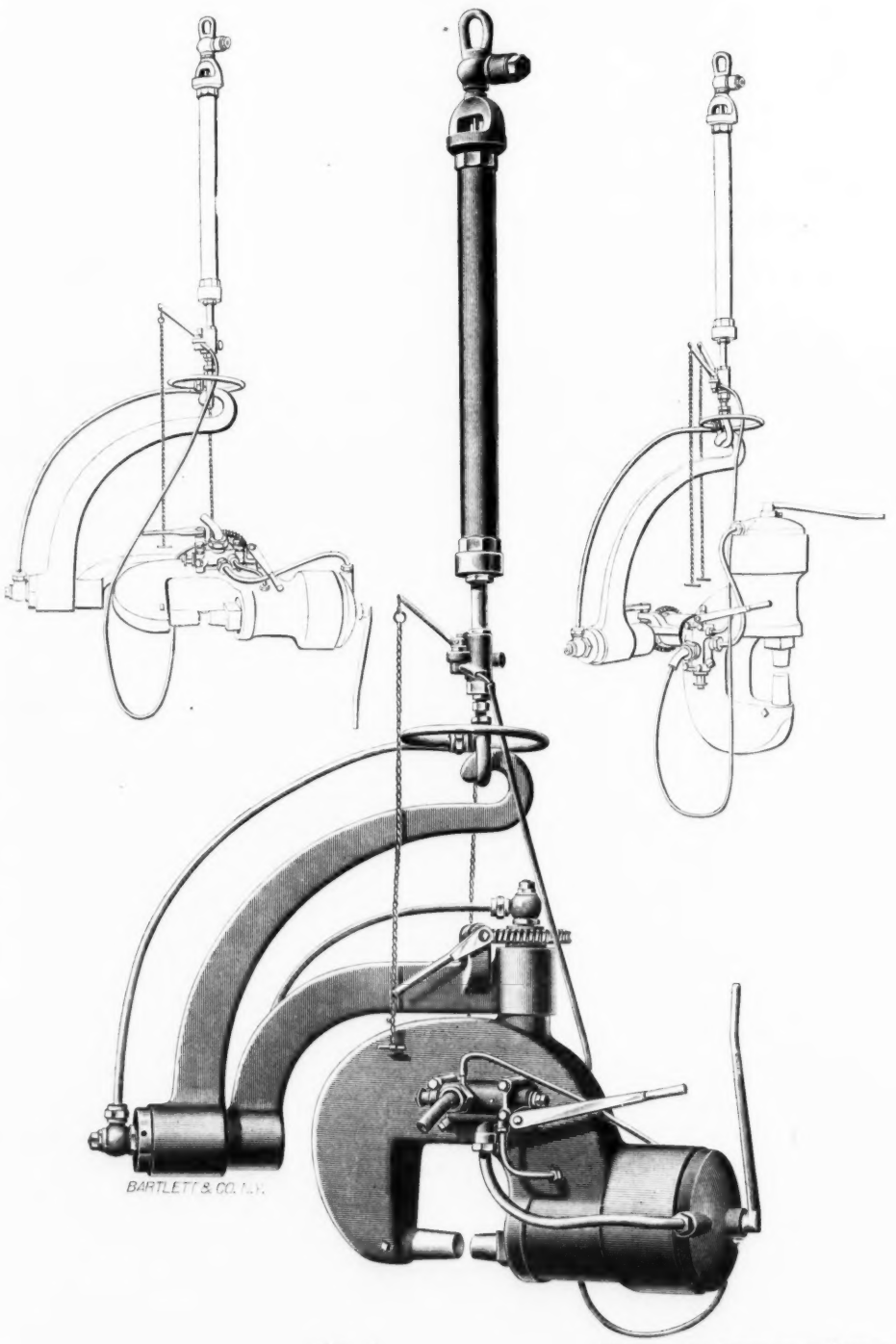


Fig. 1. HYDRAULIC PORTABLE RIVETING MACHINES. *Fig. 2*

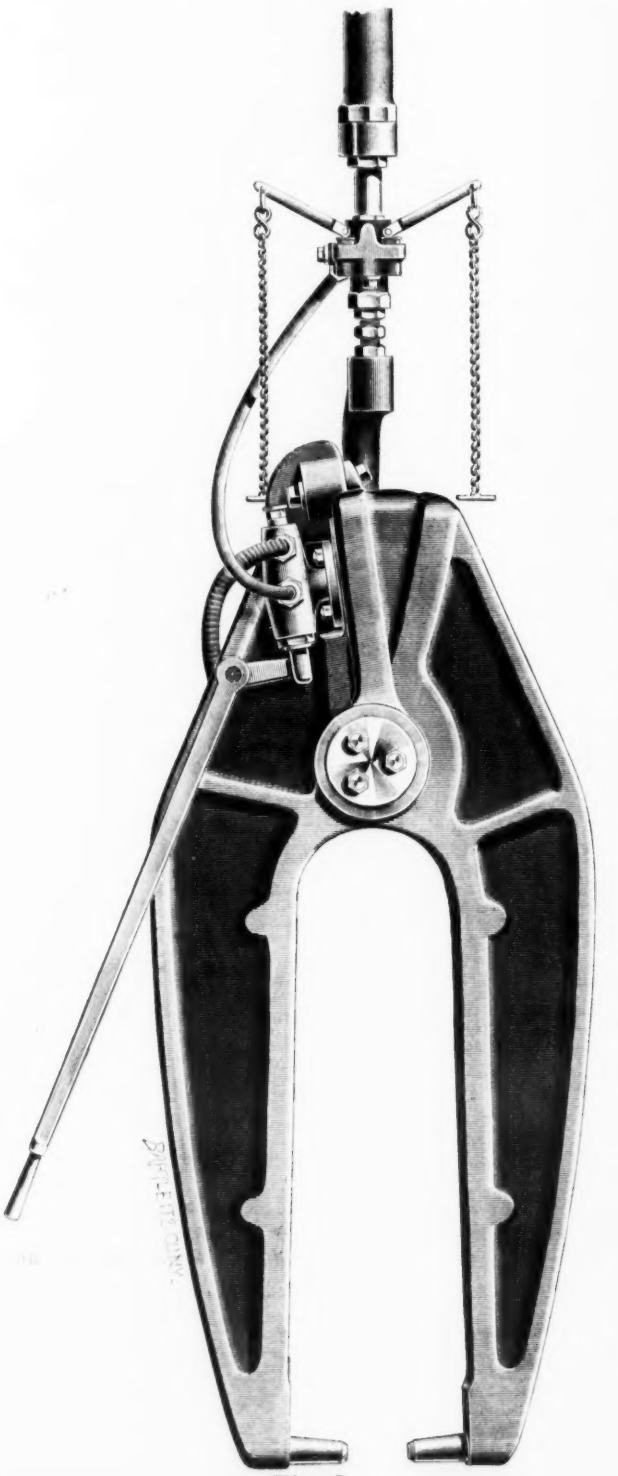


Fig. 1 shows a direct-acting portable riveter, well adapted for heavy riveting. These machines are made of any desired depth of throat, from 12 inches to 6 feet, and with power to close any size rivets up to 1¼ inches. The cut represents a direct-acting machine, having a 12-inch throat, and capable of exerting a pressure of 150 tons on the rivet. It is suspended from a universal hanger, which enables it to be swung in any conceivable position. The water pressure is supplied through a telescopic pipe, as shown; this also serves to raise and lower the machine, the smaller pipe acting as a piston in the larger one. There are two valves for the purpose of operating this hoist, which are opened and closed by levers and chains, one serving to raise the machine and the other to lower it. The frames or bodies of all portable riveters are made of cast-steel; the valves, cylinder linings and the pressure pipe hoists are of bronze.

Fig. 2 shows a lever type portable riveter; the riveting dies are carried at the ends of arms or levers of any suitable length, a joint or fulcrum being located between them and the applied power. The hydraulic cylinder is at the opposite or short end of the levers, causing the machine to act in a manner not unlike a pair of scissors. This arrangement gives two comparatively slender cast-steel arms which can reach in all sorts of out-of-the-way places, requiring but little space for their manipulation and enabling the operator to see his work distinctly. Water pressure comes to the machine through the center of the joint on which the levers work, thus leaving it free to swing to any desired position. It is also supplied when desired with a universal hanger and pressure pipe hoist. These machines are made for driving any size of rivets up to the heaviest, and of reaches from 2 to 5 feet. One of the various uses for which this machine is designed is for the riveting up of steel tanks for gas holders. A mast is set at the center of the tank, and by means of a light jib the riveting machine can be swung around the entire circle, closing every rivet in the sides. For this duty the machine is usually made with a reach of 5 feet.

Fig. 3 shows a lever type portable riveter suspended from a light jib crane by means of a pressure pipe hoist and a universal hanger. The telescopic hoist is attached to a small trolley or carriage which travels on the upper flange of the crane jib. Water pressure is supplied by means of a jointed "walking pipe" with a swing joint at the axis of the crane. This form of crane can be conveniently attached to the wall, or a column in the shop, or to a post in the yard. It is used for bridge and structural work, tanks and miscellaneous purposes. The riveter has a reach of 24 inches and is capable of closing 1-inch rivets.

Fig. 4 shows a compact direct-acting machine, designed for closing rivets around the

doors of fire-box boilers. It is also found valuable for work on mud or foundation rings, flanged joints, Adamson flues etc., and is frequently employed for riveting inverted heads on boilers. The Pennsylvania Railroad Co. in their new shops at Altoona, Pa., have an outfit of these portable machines for driving every rivet in their locomotive boilers. This machine is also convenient for use in bridge and structural work, for lattice girders, etc.

Fig. 5 shows three distinct types of portable riveting machines used for riveting up the ship's frames, together with various appliances for handling them. With an equipment of this general character nearly every rivet in the ship's frames can be closed by power. There are, as a rule, several additional machines at various points in the yard, used for any riveting which can be done to better advantage before putting the parts in position on the stocks. Water pressure is supplied to these machines by flexible copper piping, which is regularly manufactured for the purpose.

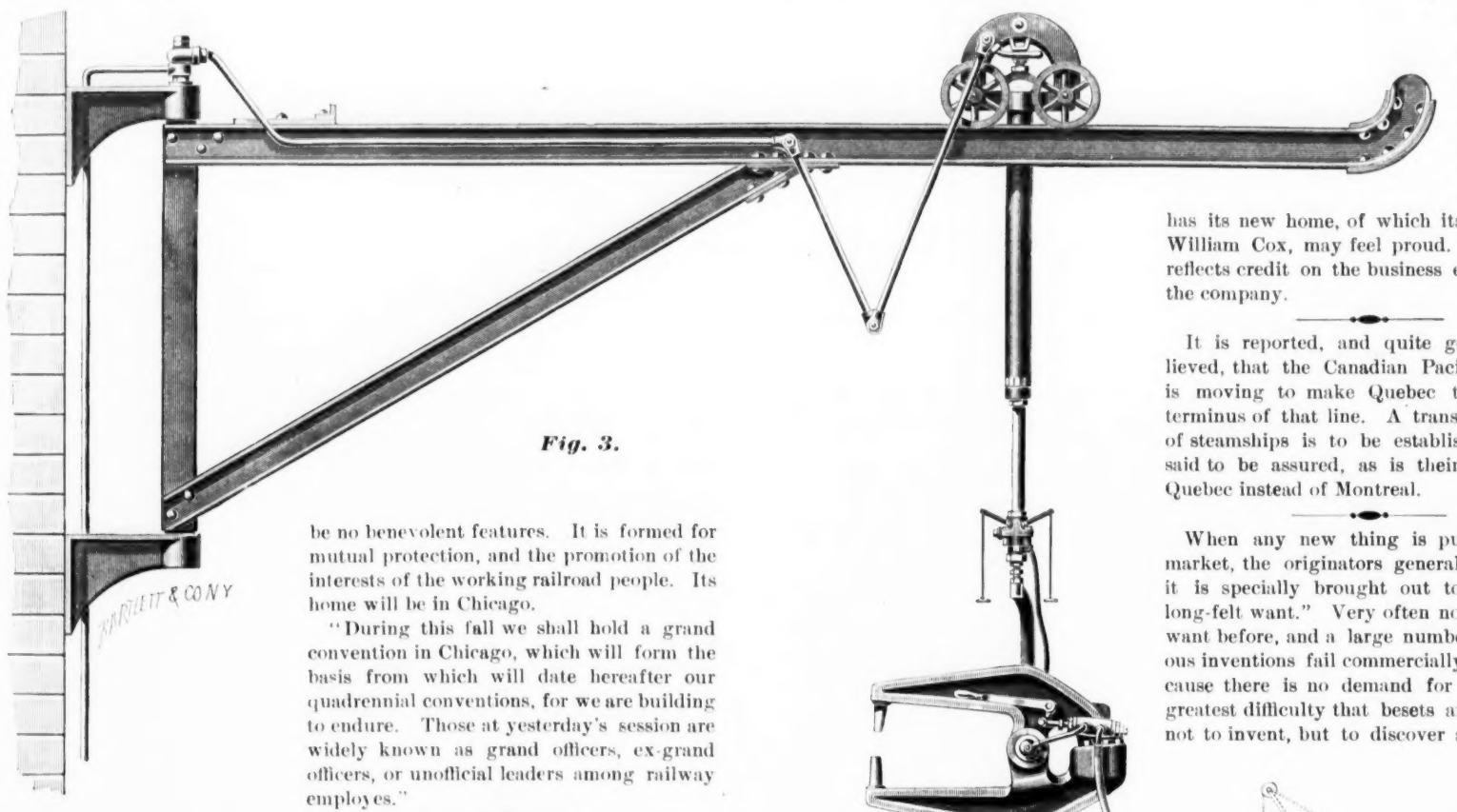


Fig. 3.

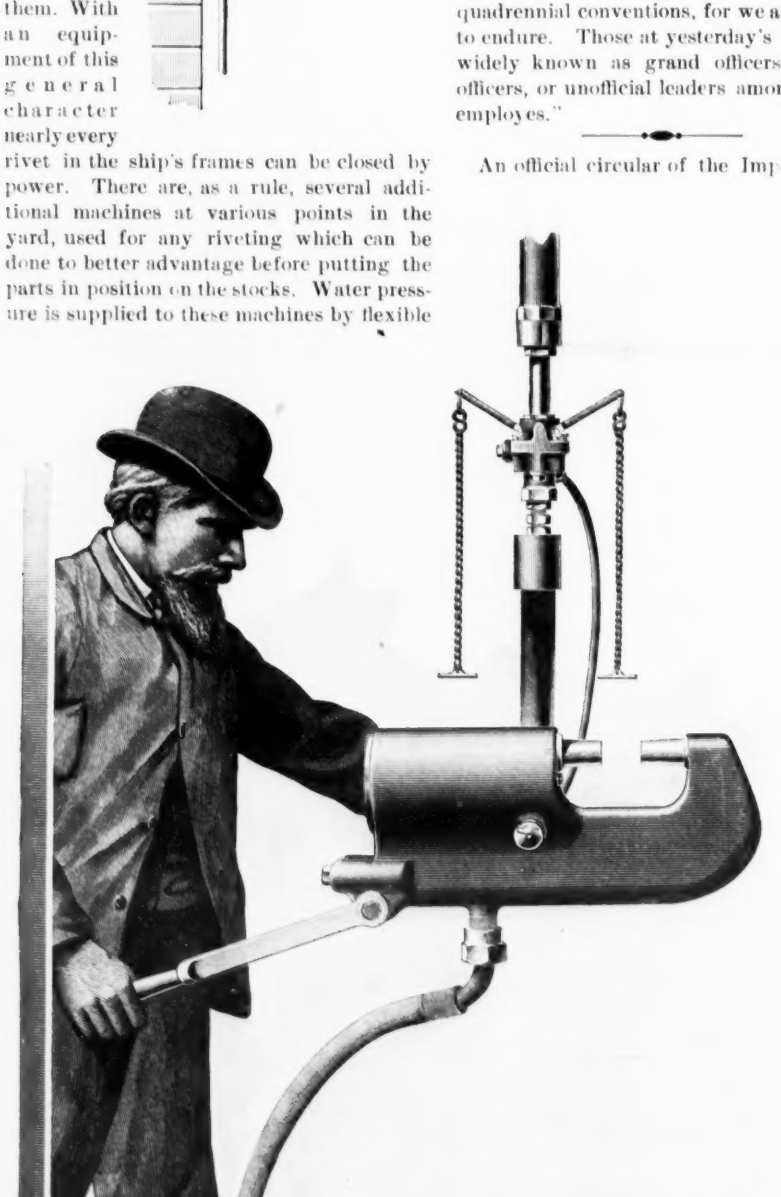


Fig. 4.

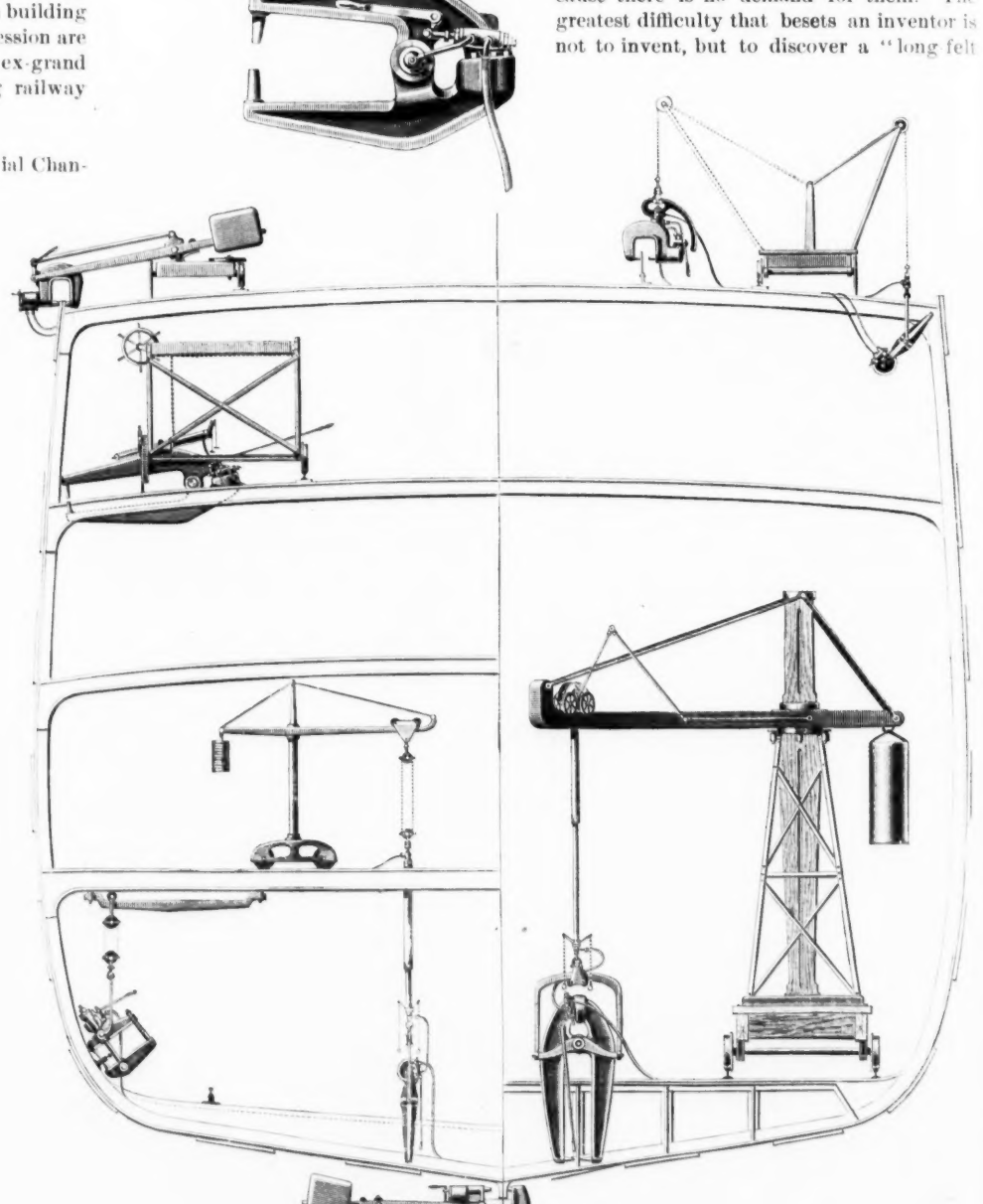


Fig. 5.

Hydraulic Portable Riveting Machines.—See Page 1.

The American Railway Union, to which we referred some weeks since, has been permanently organized. Eugene V. Debs, in speaking of it, is reported to have said:

"The union will be formed of all classes of railway employes working on trains, tracks, in shops, offices or anywhere. They will be organized by the branch of work they do.

"There will be a central body composed of one delegate from each of the branches, and then there will be a president, secretary and treasurer. That's the plan. There will be no benevolent features. It is formed for mutual protection, and the promotion of the interests of the working railroad people. Its home will be in Chicago.

"During this fall we shall hold a grand convention in Chicago, which will form the basis from which will date hereafter our quadrennial conventions, for we are building to endure. Those at yesterday's session are widely known as grand officers, ex-grand officers, or unofficial leaders among railway employes."

An official circular of the Imperial Chancellor, Count Caprivi, informs the institutes of technology, industrial schools, and other establishments for technical education throughout the German Empire that Mr. Henry Villard has placed at the disposal of the Chancellor the sum of 50,000 marks for the purpose of enabling worthy young men to visit the World's Fair, three-fifths of the amount to be allotted to artisans, mechanics, and machinists, and two-fifths to persons of other callings. Allowances will be made in sums ranging from 1,800 marks to 2,000 marks for the expenses on the trip to Chicago. The institutions in question are asked to propose to the government the names of proper persons, so that the government may make a final selection from them.—*Evening Post.*

The Keuffel & Esser Co., manufacturers and importers of drawing materials and surveying instruments, are now comfortably established in their new building at 127 Fulton street, New York. The success of this company has been such as to demand increased facilities for their continuously growing business. Their new building is eight stories high, and covers an area of 118 feet by 25 feet, and is entirely fitted up for their business. Every department is a model in its way, with every convenience required. In this building *The Compass*, a monthly journal for engineers, surveyors, architects, draftsmen and students, published by this firm, has its new home, of which its editor, Mr. William Cox, may feel proud. The whole reflects credit on the business enterprise of the company.

It is reported, and quite generally believed, that the Canadian Pacific Railway is moving to make Quebec the Atlantic terminus of that line. A transatlantic line of steamships is to be established; this is said to be assured, as is their landing at Quebec instead of Montreal.

When any new thing is put upon the market, the originators generally state that it is specially brought out to "supply a long-felt want." Very often no one felt the want before, and a large number of ingenious inventions fail commercially merely because there is no demand for them. The greatest difficulty that besets an inventor is not to invent, but to discover a "long felt want." Inventing is easy; it is more difficult to work out the details of an invention, still harder to sell it, but hardest of all to discover a long-felt want to supply.—*Industries.*

The New South Wales Legislative Assembly has passed a bill limiting the hours of labor in coal mines and collieries to eight.

Molding by Machinery—Foundry Appliances, Etc.—I.

By S. Bolland.

The object of this article is to bring before the mind of the foundryman, in as brief a manner as possible, the present condition of the foundry with regard to the various appliances now in use for the production of castings. Imperfect as it may be, it will, in some measure at least, give at a glance some idea of the evolution which has been gradually taking place around us in the past, and may serve to incite the minds of some to still further efforts in the direction of improved foundry appliances.

The several molding machines, as we see them to-day, have not sprung into existence all at once. The process of their development has been a gradual one, and not until inventors were able to grasp some, if not all, of the chief requirements for producing a well-finished and trustworthy mold, did any real success attend their efforts, even in the inferior class of work to which the limited capacity of their machines has hitherto confined them.

Before entering upon the subject of molding machines proper, it will be of interest to take a retrospect of the foundry appliances generally, past and present, by which means we shall be better able to judge, not only just how much advancement we have made, but also to trace almost from their inception the growth of the present mechanical appliances for molding.

The difference between past methods in molding as compared with the present is almost as great as that of smelting the ore, which latter can only be appreciably understood when we compare our methods at present with some of those still in use in semi-civilized countries. Fig. 1 represents a blast furnace of the Kols, a tribe of iron smelters of lower Bengal and Orissa. The men are nomads, going from place to place as the abundance of ore and wood may prompt them. The charcoal in the furnace being well ignited, ore is fed in alternately with charcoal, the fuel resting on the inclined tray so as to be readily raked in. As the metal sinks to the bottom, slag runs off at an aperture above the basin, which is occupied by a viscid mass of iron. The blowers are two boxes with skin covers, which are alternately depressed by the feet, and raised by the spring poles. Each skin cover has a hole in the middle, which is stopped by the heel as the weight of the person is thrown upon it, and is left open by the withdrawal of the foot as the cover is raised. Variously modified in detail, and increased in size, these simple furnaces are to be found in several parts of Europe at the present time.

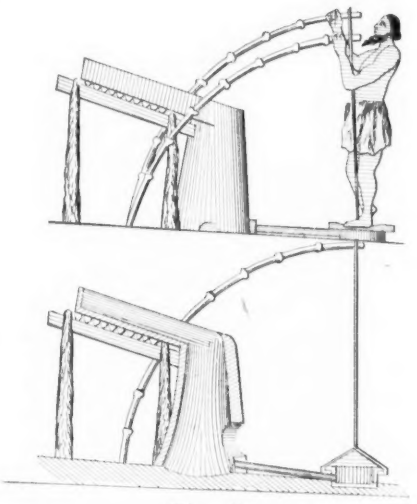


Fig. 1.

Compare the above with some of the remarkable systems of hot blast smelting now in vogue, as described in late works on metallurgy, and the change seems truly startling, yet the principle is the same in both cases, almost, the main difference being in the kind of blowing engine used and the magnitude of the operations.

CRANES.

In nothing does the spirit of improvement manifest itself more than in the choice of cranes for foundry purposes; where once the slow and pondrous wood cranes stood are now to be seen, in some places, elegant structures of steel or iron, whose every movement is controlled with a degree of accuracy unthought of by our predecessors, and comparatively unknown to many around us at this time. With the advent of electricity as a motive power, backed by a growing desire on the part of founders to apply this wondrous force to existing structures (something very easy of accomplishment), our foundries are assuming a method which, to those accustomed only to the old régime, seems almost unreal. When large bodies are being lifted they seem to shoot upwards as if propelled by magic, and lighter ones, such as parts of molds, etc., are closed together with a degree of precision unattainable by the clumsy structures which these more effective engines have displaced. No noise, no rushing through the shop for a spare crank to supply the place of the one just broken by as many hands as could crowd around it, no anxiety of foreman or men, all proceeding with a naturalness born only of perfection, and all this owing to the fact that it has just dawned upon the minds of founders that the foundry can be made more productive if sufficient attention is only given to its needs and requirements.

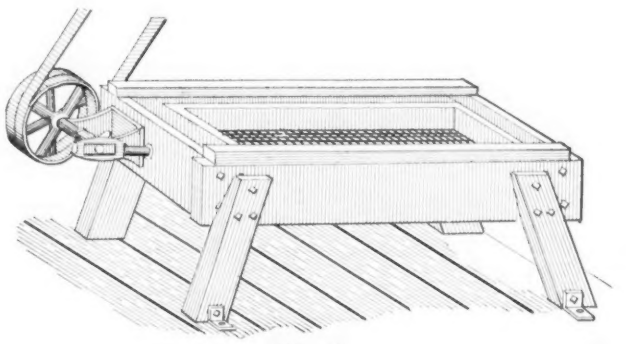


Fig. 6.

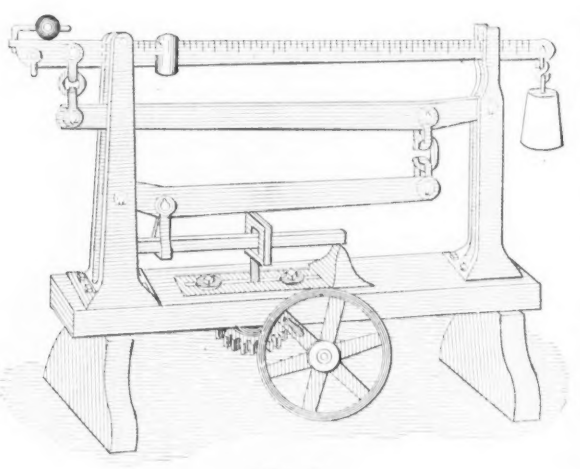


Fig. 3.

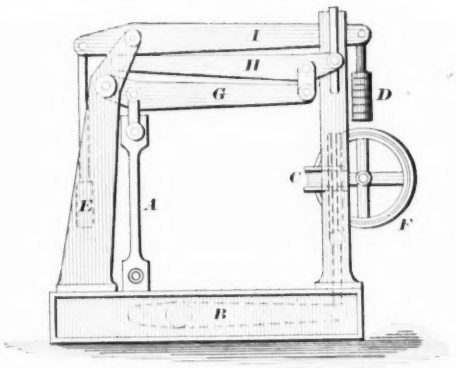


Fig. 2.

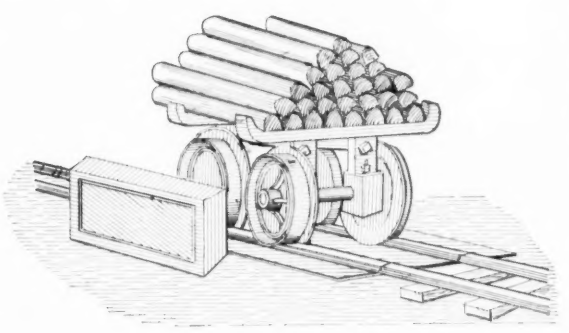


Fig. 5.

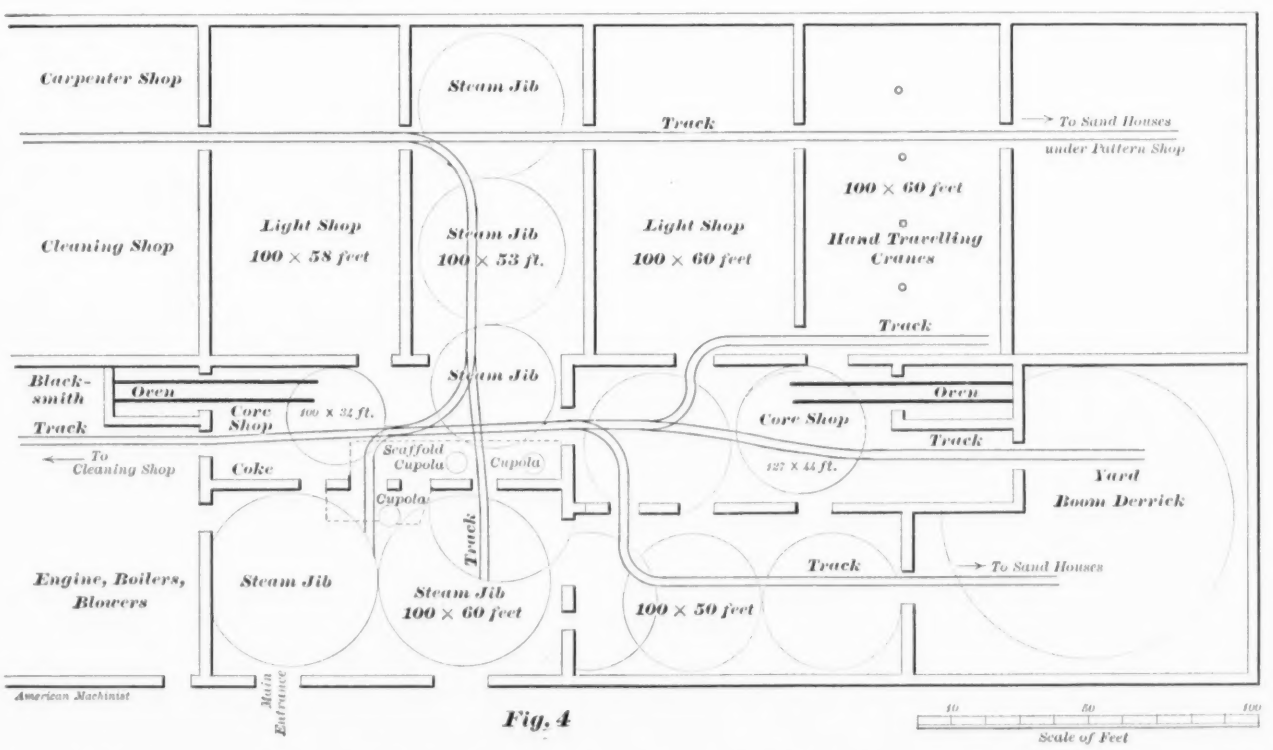


Fig. 4

The rapidly increasing popularity of the testing machine in the foundry is the sure indication of a desire on the part of founders for a more correct and satisfactory means of knowing just what iron they are using; the rule of thumb, as exemplified by the antiquated method of testing by fracture alone, is being fast relegated to the rear, its place being taken by the more positive means of the testing machine and crucible.

The machine shown in Fig. 2 is designed for testing the tensile strength of metals; the rod *A*, to be tested, is made to one square inch of section, and is held between clamps attached respectively to levers *B* and *G*. The lever *B* is acted on by a worm-wheel *C*, and worm operated by a hand wheel *F*, bringing the tensile strain upon the scale beam levers *G*, *H*, and *I*; to the long arm of the latter weights *D* are applied until the bar *A* is ruptured, or the required testing strain is reached. *E* is a counterbalance weight for the levers *G*, *H*, *I*.

How these machines are applied for obtaining a transverse test will be seen at once by consulting Fig. 3, which is self-explanatory.

TRACKS AND TRUCKS.

Where the means for transmitting molds, cores, castings and all other materials are

It is a good sign to notice the almost universal adoption of these lately invented appliances for reaching every nook and corner of the foundry with some adequate means for lifting objects hitherto lifted by hand at great risk to all concerned. The pneumatic and steam, hydraulic cranes, etc, suitable for such purposes are now to be obtained at a comparatively trifling cost. From the number of such appliances now in use, there is every indication that the convenience and general welfare of the employe is receiving attention to which he has been hitherto unaccustomed.

Another labor saving device for facilitating the rapid handling of large quantities of molten iron is becoming very popular in many of our large architectural, car, and stove shops, consisting of an overhead trolley system direct from the cupola to all parts of the shop, one man being able to pilot 1,000 pounds of iron direct to the floor, and serve each hand ladle as fast as presented, the latter operation being made very simple and clean by a hook on the band of the supply ladle, on which the molder can rest his ladle whilst it is being filled, a suitable eye on the band of the hand ladle being provided for that purpose.

lacking overhead, especially in large foundries which have assumed their present magnitude, section after section, by the process of building "*something temporarily*" for the present, as their business increased from time to time, there is now a very good substitute in a system of well-kept tracks with switches in every available direction. Specialists in this line now manufacture trucks that will turn in a 12-foot radius with ease, with loads of three tons or more, thus taking up little, if any, more room than would be required for turntables, the latter objectionable feature being, by this means, effectually dispensed with. The transmission of cores from the oven to their respective places, sand from the bins outside, and molten iron from the cupola to every part of such a shop may with such an arrangement be accomplished with marvelous facility, and with an outlay for labor that is infinitesimal compared with lugging everything by hand.

Fig. 4 shows how admirably the track system is adapted to a number of shops collected together, as above described. As will be seen, connections for both supply and delivery are well provided for; the tracks were so arranged that a steam crane lifted the iron from the cupolas onto the trucks with the least delay imaginable, and every part of these straggling places brought into intimate relation with the cupola by said means.

CONVEYERS.

May we not hope that before long the laborious and by no means desirable mode of wheeling in barrows all the material used by the sand and loam mixer, etc., will be supplanted by one or other of the much-to-be-admired systems of conveying which are becoming so common almost everywhere except in the foundry? These means are pre eminently adapted for foundry purposes, inasmuch as everything could then be hauled to its destination clear of the foundry floor altogether. Mines, mills, and quarries are duly supplied with fast or slow speed elevators and conveyers with a perfect discharge, grain is handled in such a manner as to leave no trailings behind, and different grades handled by the same conveyer (something very suggestive of its adaptability to foundry use), clay at the brick yards, coal at the wharves and elsewhere, tanneries, tile and stone yards have these splendid appliances in full swing, but, as usual, the foundry is last in the race.

ELEVATORS TO CUPOLA SCAFFOLD.

Looking at the very excellent arrangements for elevating material to the charging platform at some of our foundries, one is forced to the conclusion that improvements began first at the outside, and only very slowly found their way into the foundry proper; however, it is a satisfaction to know that the interior has at last been reached, and every part is now receiving its due share of attention in all well-regulated shops. The advent of the ordinary elevator made it possible to banish forever that slavish and expensive mode of carrying by hand all the iron and fuel to the scaffold, but it is evident that very many cling tenaciously to these time-honored notions, otherwise we should see some scheme invented, even in the meanest places, by which material could be handled more sensibly as well as profitably.

The common freight elevator may be very readily adapted to almost any foundry, and these, owing to the lively competition of makers, can be furnished at a remarkably low cost. The writer has had an every-day experience of 75 tons of melted iron per day at a foundry where both iron and fuel, great as was the quantity, was lifted from the foundry floor to one end of the scaffold in iron cages holding about five tons of iron, and deposited on a truck which, by means of a suitable track, was conveyed to each of the three cupolas in use respectively. The crane used for this purpose was an ordinary jib with a reversing engine behind, and whilst it may appear a somewhat rude method compared with the best practice of the day, it was very effective.

CUPOLA SCALES

It is a great saving of time, as well as an aid to correctness, to provide a scale with several beams and poises, so that a truck may be at once filled with the several quantities of different irons which go to make up a charge. This allows the proportional quantities to be collected on the truck instead of obliging them to be carried separately to the cupola. The iron truck at Fig. 5 is shown on a section of railway upon the scale platform; the beams are concealed, but are supposed to be provided with indicators, which pass through the top of the beam box. There is no doubt but this method originated at the car wheel foundries, where the cupola scaffold is, in many instances, connected with the yard direct by a line of railway on a constructed incline. It is even easier to adopt this scheme where the truck can be run from the scale to the elevator platform on the level, and not a few of our wide-awake firms have adopted the scheme.

SAND RIDDLES.

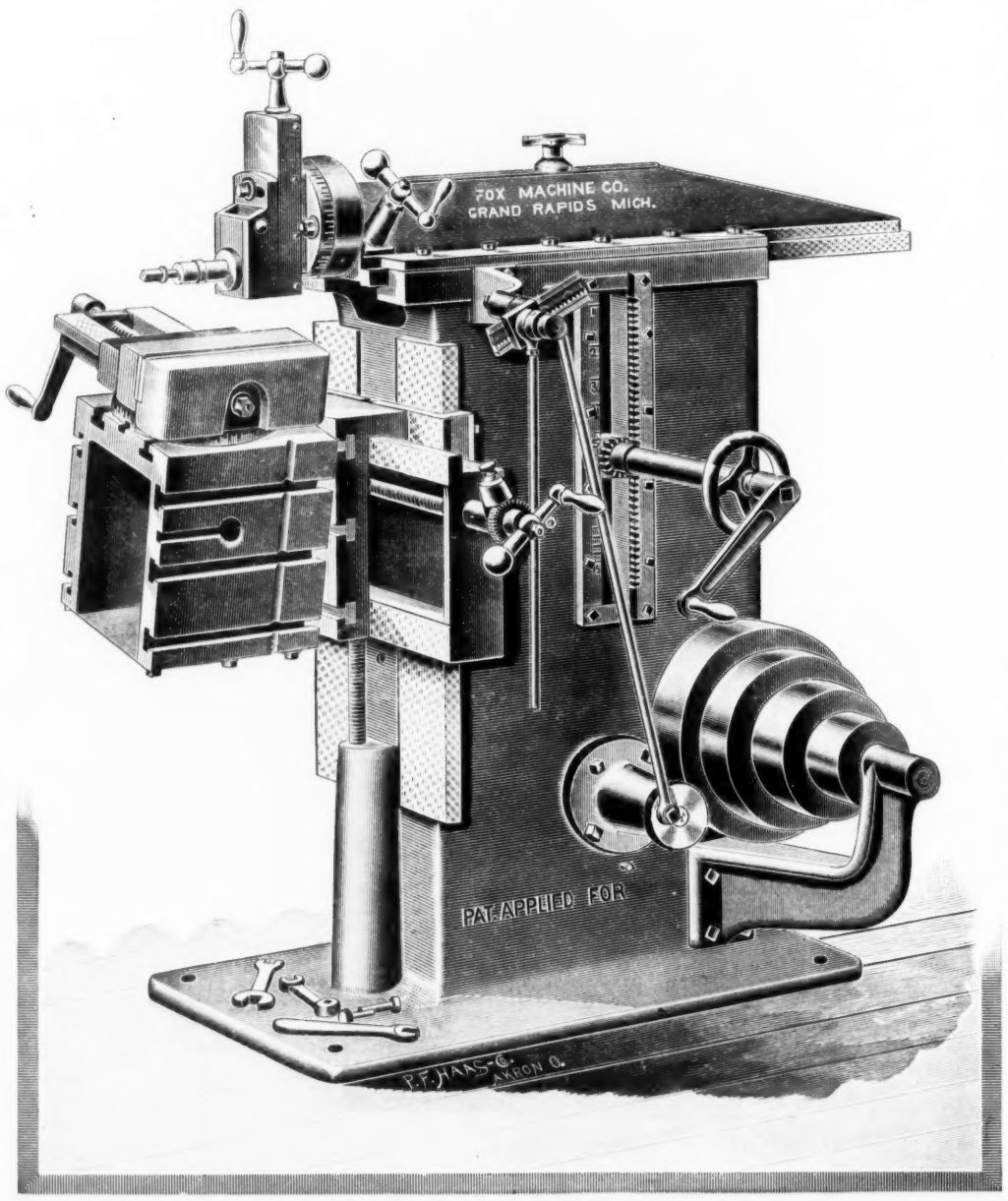
The sand riddle shown at Fig. 6 is undoubtedly the result of an evolutionary process easily traceable through all its several stages or periods; at first the tiresome and back breaking standing with riddle in hand to receive shovelful after shovelful of sand from an associate, to be either freed from scraps or more effectually mixed and tempered; then the stick with a nail inserted at each end, one of which was to thrust into the floor to prevent slipping, the other to protrude through one of the meshes at the front of the riddle, thus relieving the operator of nearly one-half the load as he jerked his riddle back and forth, and again the mortar mixer's screen brought into the foundry, perhaps surreptitiously from some new building in course of erection near by.

Finally the machine as intimated, which is supposed to give a combination of all the motions incident to ordinary riddling, saving, at least, half the labor and the time also. Whilst this figure serves to show a very popular power riddle now in use at many foundries, it by no means covers the field of invention for this end. A very good one by J. Evans & Co., Manchester, Eng., hooks the tray into slings which depend from any convenient support above by means of straps bolted on the frame. The tray is formed of a piece of $\frac{5}{16}$" plate iron, bent round to form three sides of a rectangle, the fourth side being left open. A series of half inch bars pass across the frame, the action of the uppermost bars being to assist in breaking up the large lumps of sand. The sieves, which are interchangeable, are laid over the lower bars. The oscillating motion is imparted to the frame from a belt pulley, which drives a three-toothed cam pinion; these teeth thrusting alternately the pins in the slotted piece attached to the bar which actuates the frame, communicate a rapid jarring to and fro motion thereto. The fine sand falls through the sieve into a bin below, and the unbroken lumps pass on and fall out at the open end.

A revolving screen, lately introduced in some of our leading shops, is no doubt the most effective machine yet seen for mixing heavy piles of sand, and promises to supersede all other contrivances yet invented for that purpose.

CLEANSING MILL.

The simple tumbling barrel was the first attempt made to supersede the old method of cleaning small castings with old files and pieces of sandstone or emery. How well some of us can remember the army of little boys and old men employed for this purpose at all such firms as manufactured large quantities of small work. This simple machine, like all others since introduced, cleans and polishes castings by attrition, and consists of a cylindric or barrel-shaped vessel, composed of perforated slabs bolted to the two ends, having a side door for the introduction of the work, and mounted on an axis so as to be revolved by a wheel or pulley. Very many improved ones are now in use, but all aim at the one object of cleansing by the introduction, along with the castings, of slag or cinder which, as it breaks up by constant abrasion with the castings, cleans the latter from all adhering sand which escapes through the perforations, leaving the castings clean within the barrel. Some are now provided with an exhaust apparatus for conveying away the dust—a very desirable acquisition it must be said—are friction geared, and provided with hand-wheels for stopping and starting. Others again are revolved on chilled truck wheels, the heads having guides turned thereon for the purpose, thus doing away with axis on the head altogether. A great saving of time is effected when two barrels are employed, as in this case one may be kept running whilst the other is being loaded or unloaded.



A New Crank Shaper.

A New Crank Shaper.

We present with this an illustration of a crank shaper, in which the crank itself has a stroke of constant length for all strokes of the ram, and in which the stroke of ram, position of ram and rate of feed can be changed at will, while the machine is in motion, and without need of change of position by the operator.

The usual slotted lever is employed, which occupies a vertical position within the column, its upper extremity being connected to a nut which is attached to the under side of the ram. This nut is fitted to a traversing screw which runs along the under side of the ram, and is turned by the hand crank seen at the right of the ram, this being connected by miter gears, thus affording means for changing the position of the ram while in motion.

The lower extremity of the lever is slotted and carries a sliding box in which the crank-pin works, this crank pin being upon the face of a gear near the bottom of the column and running in a bath of oil. This slot gives the quick return motion, the back stroke being made during 130 degrees of revolution of the crank, while the cutting stroke occupies 230 degrees and is practically uniform throughout its length, the back stroke being, however, much the most rapid at the middle.

The pivot or center upon which the slotted lever vibrates must of course be between the nut and the crank-pin; and instead of being fixed is movable; this being accomplished by providing a slot in the lever through which the pivot shaft passes, and is provided with a square box to give ample bearing. This shaft and box are then raised or lowered to any desired point to give any desired stroke by means of two pinions and two vertical racks attached to vertical openings in the column, one on either side: the right-hand one appearing in the illustration. The movement is effected by the hand crank and the pivot is clamped in place by the hand wheel seen. As the pivot shaft is moved towards the crank and away from the ram, the stroke of the latter is increased, and *vice versa*, the shortest stroke being about ½ inch and the longest 15 inches. Graduations at the side of the opening at the right indicate the stroke for any setting. A special belt shipper is provided for the cone belt, which enables it to be shifted from one step to another very quickly, and the four steps give 12, 20, 34 and 60 strokes per minute, the cone pulley making 7 turns to the crank's one.

The feed is changed by a sliding block upon the upper lever arm, this block being

moved by a rack and pinion and the pinion held by a spring pawl, which permits it to be moved readily by the operator.

The table is pivoted as shown upon the upper one of three bolts that secure it to the saddle, and two taper pins hold it in its normal position. By removing the three bolts, before mentioned, the table is readily removed for bolting work direct to the saddle. The vise has steel-lined jaws and the thrust of the screw is taken back of the stationary jaw. The vise can be placed in two positions on top of the table and in one at the side, a key lining it up accurately.

The motion of the table on the cross-rail is 19½ inches; vertical adjustment of table 13 inches; weight of machine 1,800 pounds. It is built by the Fox Machine Company, Grand Rapids, Mich.

String Routing Machine.

This machine is designed for letting in the risers and treads of steps. Two swinging arms are swiveled to each other and to a bracket fastened to a post or wall. A dovetail cutter is carried at the end of the second arm, and can be moved freely in any direction by means of two handles fastened to the two arms. These handles are so placed that the operator is always able to apply his strength to the best advantage in feeding the cutter to the work.

The arms being of hollow or tubular section are light but strong, and owing to this fact and to the wide spread of the swivel bearings the machine is very light and easy to handle, although very powerful and stiff. The spindle has a vertical adjustment to regulate the depth of cut, and is provided with an adjustable stop.

Only two forms or patterns are required, one for heavy and one for light steps, and as the part that works against them does not revolve they need not be lined with metal. These are made by the user to conform to his practice; and are usually constructed of three thicknesses of hard wood glued together, with the grain crossing The operation is as follows:

The string-piece is marked out in the usual manner and laid upon the table of the machine. The form is placed upon the top of it and secured firmly by means of two clamp screws provided for the purpose. The cutter is then fed in, guided by the form, and cuts out for riser, tread, nose and wedges. Different runs, and right and left, are all produced by the same form. It is well, when possible, to have a table nearly twice as long as the strings, and, if the latter be very heavy, to insert rollers in it. To save room, this table is frequently placed about 7 feet above the floor, the operator standing upon a platform.

The pulley on upright shaft is 8 inches diameter, 4 inches face, and should make about 1,160 turns per minute, giving the cutter 6,000 turns. Hangers and loose pulleys are self-oiling. The machine is made by P. Pryibil, 498-510 W. 41st St., New York City.

LETTERS FROM PRACTICAL MEN.

The Ann Arbor Decision.

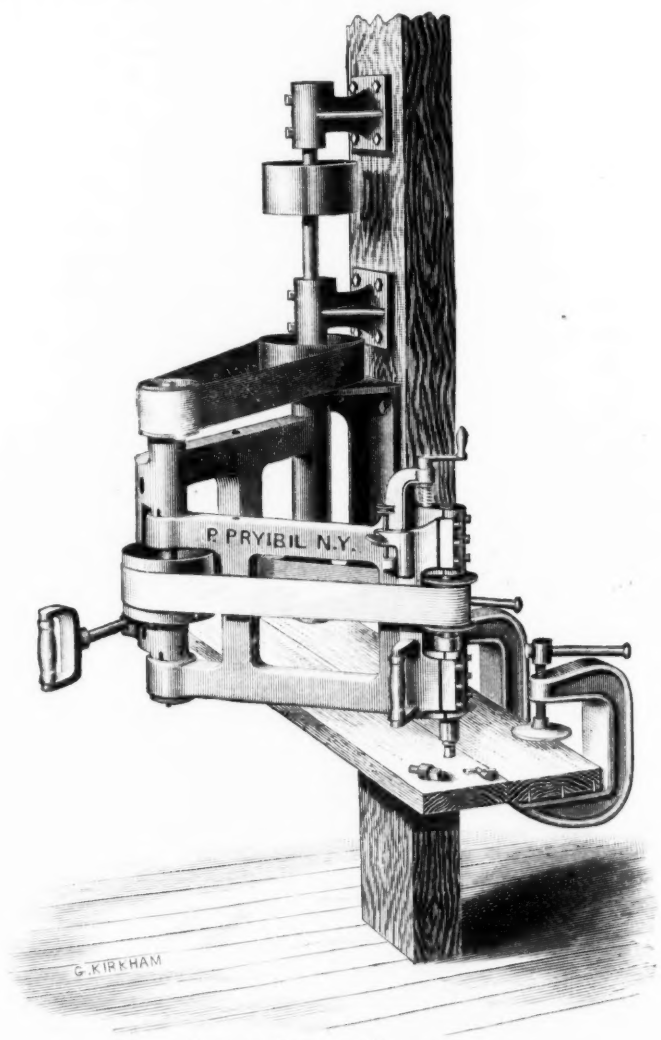
Editor American Machinist:

The recent decision in the U. S. court concerning the boycott against the Ann Arbor & N. M. R. R. has been much misconceived, and it appears from your issue of March 30, the American Machinist has not entirely escaped. You think it involves a new principle, but in that you are in error. The principle is an old one—old as the common law, but one which it has not often been necessary to invoke.

All combinations or actions in restraint of trade are unlawful under the common law, and have always been so since that law was formulated. It has not been announced as a restraint upon labor organizations *of late years*, until the U. S. judge in N. O. the other day announced it. The rights and duties of common carriers are also well understood. One who engages in business as a common carrier assents to and assumes those obligations, and they cannot be summarily abandoned without reference to public convenience. The owners or operators of railroads are common carriers, whether they occupy the positions of masters or servants, and they all equally assume the obligations which pertain to that calling.

This does not imply that a man or a corporation cannot withdraw from that occupation, but that he must not withdraw at a time or in a manner which will cause damage, and this means that if he does so withdraw, the right of action for damage will lie against him.

To illustrate this point, supposing the owner of a railroad suddenly decides to quit the business, and arrests his trains anywhere they happen to be. It is easy to see the goods in his cars would not be delivered and their owners would suffer loss. If that thing happens he must make good the loss. It makes no difference to the sufferer whether this detention takes place by reason of a decision on the part of the railroad company, or a strike on the part of the employes of the company, the loss and right to damages exist just the same. But the shipper does not contract with the engineer or brakeman



String Routing Machine.

but with the company, and the company is answerable in damages, and the company in turn has its right of recovery against the employe.

Supposing a farmer sends his hired man to a distant town with a load of grain, and midway the hired man decides to quit, and does so, abandoning the team and load to its fate. It would be hard to find a reasonable man who would carry the right to quit far enough to justify that act, but it is the same in essence and is equally covered by the law.

The simple fact is that every man who accepts employment from another does so with an implied agreement not only that he will execute his duty with skill and faithfulness, but that he will not cause damage by the manner of his quitting. That is the law, whether occasions for enforcing it occur often or not. It is no stranger to the courts, however, and is likely to become more familiar in the future. R. D O. Smith.

A Question.

Editor American Machinist:

I had the pleasure a few days ago of visiting the works of one of our largest Western firms of tool makers, and was much struck by the large number of milling machines in successful use for various kinds of work.

There seemed, however, to be the need of large and powerful machines. I was shown heavy work being roughed out in high-class milling machines preparatory to being finished on the planer; the reason for this was that it was cheaper to rough out on the milling machine than on the planer, but the heaviest milling machines made were too light to accurately finish these heavy castings where large surfaces were to be cut.

I was informed that for light cuts a speed of 35 feet per minute could be used with safety for cast iron. Is not this excessive?

The manager also told me that cutters for gear cutting were now made which accurately preserved their form, even though three-quarters of the tooth were ground away.

I do not, however, see how this can be so, as some side clearance is necessary, in addition to that obtained from the eccentric forming of the teeth, so that as the tooth is ground back from the face it must grow narrower.

Will some reader of this paper kindly enlighten me on this subject? Greko.

Steel for Cams.

Editor American Machinist:

A correspondent in your issue of March 30 specifies cast iron as the best material for heavy cams, observing that steel castings do not wear well, the resistance to crushing being less than close cast iron, etc.

These remarks are doubtless prompted by experience derived from castings of soft steel. It will be remembered that steel castings can be made from any grade of the metal from a very low percentage of carbon, and as high as one per cent., or with a tensile strength varying from 40,000 to over 100,000 pounds per square inch of section. Each grade possesses advantages for the purposes it is best suited for, but the very soft grades of steel are not adapted to rub on each other in frictional contact—the rubbing surfaces seize and cut with remarkable avidity. This tendency to cut lessens as the tensile strength of the steel increases Heavy gearing, cams, etc., made of soft steel are speedily destroyed, while satisfactory endurance is obtained from the harder grades. I know of numerous instances where heavy gearing of soft steel was destroyed after a few months of service, while hard steel from the same patterns and doing the same work has lived as many years, with the promise of life for many years more. The carbon in this steel can safely be from .5 to .7 per cent., or the tensile strength about 100 000 pounds per square inch. The soft castings may be superficially case hardened if desired, or either grade may be strengthened and their wearing qualities improved by oil tempering, or even simple air-hardening, the latter operation being performed by cooling in the open atmosphere from red heat This hardening can be done even with castings of somewhat complex shape. For the harder grades of steel, however, the hardening described makes subsequent tool finishing more difficult. Hard steel castings will be found satisfactory in cases where cast-iron is not strong enough for the purpose, and presents wearing surfaces surpassed only by chilled cast-iron. J. C.

Cams and Cam Rollers.

Editor American Machinist:

Like "Easy Way," in your issue of March 30, "I have been expecting things which have not been said" in the cam roller discussion, and have one of these things to say.

Aside from the theoretically best form to be given to cam grooves and rollers for certain forms or types of cam, the condition most essential to the proper working of any cam and its roller, and to insure that the latter does not stick or refuse to revolve at sundry times, as they are obstinately prone to do, is that the pressure on the roller be not exerted at or near one of its ends.

It is quite impracticable in the average construction and with the very best quality of workmanship to insure that a cylindrical roller, running in a correspondingly formed groove, shall be borne upon equably and at all times throughout its length; in fact, this is strictly true whether the roller be a cylindrical or a conical one, and particularly when either is new.

The prolific cause of the sticking fast of cam rollers is that, under the most accurate practice possible, when the combination is first put into operation, the cam surface will bear at times and places on one or the other of the extremities of the roller, causing the frictional resistance to the rotation of the roller to become great through transmitting this pressure to an extremely small area of bearing upon its pin; and as most cam rollers run upon an overhung pin, the trouble is intensified when this pressure falls upon the free end.

When a cam roller begins to refuse to revolve, at any stoppage there is a tendency to begin the formation of a facet upon its surface, which immediately assists in its own further development at every revolution; until it gets so pronounced that the roller no longer revolves, except to bring this facet (or facets, if more than one, as is often the case) into contact with the working face of the cam.

The writer for a number of years had to do with a cam and roller, which, from conditions inseparable from the design of the machine of which it was a part, was of such proportions as to be about the most unfavorable possible to the roller, performing its functions properly as such. That is to say, the outside diameter and length of the roller was very small compared with the diameter of the pin upon which it was expected to revolve; while the duty required of it and the pressures upon it at times were considerable. Being tied to the abnormal proportions of unescapable conditions it was necessarily a source of much trouble in every new machine to get this roller to surely rotate. It was found, however, after a good deal of fault-finding with the fitting and the grinding (it was a case-hardened roller ground to fit a hardened and ground pin) to say nothing of the amount of subsurface wickedness indulged in by all concerned, that with a good deal less attention to the accuracy of fitting, etc., so long as either the cam surface or the roller was

prevented from bearing upon each other anywhere other than at or near the center of the roller's length, there was never any objection to revolving on the part of the roller.

It was not at all necessary to give the roller anything like a pronounced barrel shape, such as shown in "Easy Way's" Fig. 6; it only required that at first starting off it was rendered certain that the entire circumference at or near the ends did not bear on the cam. If the cam or roller, or both, subsequently wore so as to bring the whole length into bearing, as it was sure to do, the rollers would continue to revolve as well as at first; from the fact, probably, that when this condition was reached the roller bore upon its pin equably throughout its length, exactly as it must do at first when the cam was made to bear upon the roller only at or about the middle of its length.

Rollers of this kind which did not stick at the outset never did so from subsequently wearing to a bearing between roller and cam; and the writer has knowledge of their use continuously for twelve or fifteen years without trouble of this kind, while he had many cases of facets worn on the rollers in the first few days of running. It was a rare exception that a new machine would be started up in which this roller did not at first obstinately refuse to revolve, and until the cam (being a reciprocating parallel one and the easier to do) was eased off by file or scraper, so that the roller bore only at or about the middle of its length. In most cases it would doubtless be the easier to slightly crown the roller.

Applying this consideration to those forms of rotating cams in which a cylindrical roller does not theoretically make rolling contact with the cam except at one point in its length, as for example, "Easy Way's" Fig. 3, we may assume that if we insure that such a roller bears at about the middle of its bearing length when first starting up, those parts on either side of that center line will, as soon as worn to contact, have more or less sliding action between cam and roller at those points, and this very tendency to wear at either side of the initial bearing line will keep the greatest pressure on the pin at or about the center of the length of the roller thereafter.

Experience with this form of cam and roller has since verified what the earlier experience taught in the simpler case; and since the one precaution of insuring that the cam, of whatever form, at first starting, bore principally upon the center of the roller's length the writer has had no trouble from failure to revolve on the part of cam rollers, even when necessarily of proportions unfavorable to their successful operation; and he believes that the consideration herein presented is of vastly greater importance than whether or not we so arrange and proportion cams and their rollers that there may always be a true rolling contact at all times and at all points between them.

John T. Hawkins.

Measurement of Irregular Surfaces.

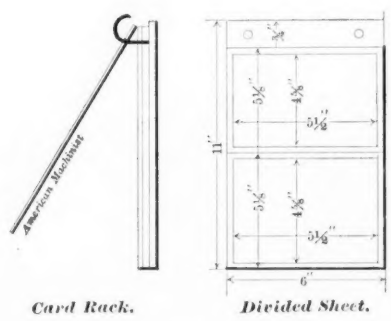
Editor American Machinist:

Having read with interest the contribution by Mr. A. S. Mallory, which appeared in your 26th January issue, I am led to present a method that I have used for determining areas of irregular form, which may be worth a place in your columns. I proceed as follows: Lay out the required figure on, say, cardboard, and then carefully cut out the figure and fill in the space with a single layer of fine bird shot, all that can be got in. Next place two straight-edges in a parallel position one inch apart, with a stop for the shot at one end, and fill in between the straight-edges with shot from the area figure one layer deep. The length of the space filled with shot between the straight-edges in inches will be the number of square inches content of the area figure.

Irregular areas have been determined by laying them out on cardboard, cutting out the figure, then weighing stock and figure pieces together, next noting weight of, say, figure piece, and taking the difference in the weights as a basis of computation. But I prefer to deal with the problem on a somewhat modified principle, to wit: Cut out and place area piece on the scales, and from the stock cardboard cut strips one inch wide, and use a sufficient quantity of the strips to balance the area figure. The aggregate length of the strips will, of course, be the number of square inches in the area figure. By this plan we avoid the use of the ordinary scale weights, and the arithmetic involved in the usual way of procedure.

I have measured solids of an irregular form by placing same in a suitable box of known size, and filling in about the solid with clean dry sand to an even depth to cover it, and noting the depth of the sand; then remove the solid and level sand to an even depth, then measure its depth again. The difference between the two depths and the box size gives a basis for computing the content of the irregular solid.

W. H. Croker.



Card Rack. *Divided Sheet.*

Clippings and Note-books.

Editor American Machinist:

Although this is an old subject, there still remains something to be said, and, as it seems to me, that I have hit on a better plan than the one I last communicated to you, it may interest some of the readers to hear about it. I do not claim it all as original, as it is merely a combination of different ideas and suggestions from several sources, but it seems to fill the bill fairly well, so far. I still retain my "accordion skirt" letter files, and keep in them the general information which it seems best to collect, but have removed much that originally filled them, for found it inconvenient to fish out tables of "belt contact or strain, power of rope drives, or calculated costs of steam plants for electric roads per horse-power," etc., etc. Still the scrap-book idea has not forced itself again into my favor, and mainly for the reason that it is next to impossible to arrange one systematically, for if you allow one page for "feed-water heaters," for example, you are sure to want more, or if you allow three pages for "Steam Engine Economy" and management, you may not want it all, and if you do, you have things mixed up in a fashion after Haswell's Handbook. Tables which are on one side of the paper only I now paste on cards of light manila stock, just stiff enough so as not to warp badly from the paste, and have holes punched in the top so as to drop over a pair of hooks on a board, as shown in the cut, the hooks being curved so as to allow the cards to be turned up for examination on the back side without dropping off the hook.

These are made about 8x10 inches, and seem to be a very convenient size, although this is immaterial, and can be suited to the fancy of the compiler. In this way you can keep the same subjects together, using separate cards for them, and adding as many cards to the list as occasion demands, leaving blank the portions of the card not occupied by the subject in hand, which avoids mixing the subjects, as is usually the case in scrap-books. There can be a cover for the case which can be made to exclude dust very easily, if desired, although there is little trouble from this unless the room be very dusty, and when hung near the desk makes a very handy way of referring to tables. When tables occur on both sides of the paper and two copies cannot be obtained, I either copy one table in the book (to be described later,) or sometimes copy both and preserve the original, and paste the other one to the cards, or else preserve such in the letter files. Not only tables, but demonstrations of various methods of calculations that are likely to come handy, and what other matter seems of value and likely to be required at short notice. Now comes the note book itself, which may or may not be new to a great many. Procure some stout leather covers of the required size (mine are for paper 6x11 inches,) and have your sheets cut to suit, with eyelets for binding into the cover, as wanted, similar in this respect to the cards before mentioned. I use a thin calendered paper that takes india ink nicely, and does not show through badly, and that prints nearly as readily as tracing cloth itself. I usually divide the sheet, as shown, with lines for borders (although where this is undesirable it can be omitted,) and fill in each frame with whatever information it seems desirable to preserve; sketches, tables, or formulas can be preserved with equal facility. Use but one side of the paper, and then for every-day use make a blue-print of the pages you are likely to want, and have them near your desk or drawing table. This will preserve the original from soiling or wear, and will allow as many copies to be made as necessity calls for. My object in dividing the sheets, as shown, is for the purpose of having a smaller size that can be carried in the pocket when necessary. The tables wanted can be printed from the book, the prints cut in two and fastened in a little pocket-book, so as to be conveniently carried, and then there is no large book to look out for while away from home, and where every available pocket is already full.

In addition to these there are, of course, the pocket note-books in which to jot down roughly whatever comes to hand, and these can be transferred to the others if their importance warrants it. Returning to the letter files; it is advisable, in addition to having each compartment labeled with the title of the branch it represents, to keep a little note-book, and jot down the articles as they are filed away. Thus: "Efficiency of Pump and Injector—by Professor Blank Tester—American Machinist, January 4, 1889," and this tells the whole story.

In addition to this, I have acquired another habit of late—at the suggestion of an old, but well-versed mechanic whom I have had the good fortune to meet—namely, to keep a little book in which to jot down the names, dates, and publication in which articles of interest appear.

Thusly, "Performance of 1,500 H. P. Vertical Engine, by Engineer, in *Power* for March, '90, page 4," which might save considerable time in looking up such matters when the index of the paper did not happen to be at hand.

I have been greatly interested in the patent discussion, and while both sides have presented good arguments, it has seemed to me for some time past that the plan of granting a *monopoly* patent was hardly right or just, either to the public or the inventor. If the inventor has capital behind him, and can manufacture the patented articles without competition, he can charge the consumers any price they can afford to pay, regardless of the actual worth of the article.

But the majority of patentees are not backed by capital, and although their invention may be better in every way than anything on the market, they cannot manufacture it themselves, and many times cannot sell the patent, or if they do with a promise of the royalty on every one manufactured, may find that, like "Bill Smith and his monkey can," but one is made and the invention quietly "shelved." This not only deprives the inventor of his just reward, but also deprives the public of the benefits of a newer and better article than ever before produced.

Having a monopoly allows this to be done; without a monopoly this would be impossible, as if the large firm would not make it, or if they charged too much, the smaller firms could make it and undersell them. It is far from my intention to remove any incentive to invention, and, on the other hand, I think that, with few exceptions, the inventor would be better off than at present, when, if reports be true, the bulk of the rewards go to the manipulators of the stock market or of the patent, instead of to the inventor. The plan that seems to have many good points and fewer bad ones than the present one (and which is not by any means original with me) is to have the patent open for the use of any one who cares to manufacture, on payment of a royalty or fee to the inventor. This would place every manufacturer on an equal basis—as far as patent rights are concerned—and the public would get the article for somewhere near its cost, which is not done at present. Included in the cost of every manufacturer would be the royalty to the inventor, the other costs depending upon his ability to manufacture.

This would prevent any concern from shelving "Bill Smith's monkey can," and thereby keeping the said Smith from his just rewards, and the public from the benefits of the invention, for if they would not make the article some one else would. Of course, many will say that no firm would manufacture anything but articles which they could absolutely control, and a few might try to verify these predictions, but when we consider the many articles on which there is no patent, and which depend entirely upon the ability of the makers to produce them as cheaply as their competitors, these objections have little weight. This is not offered as a panacea for all the social or financial ills of our present civilization, and would not in any way alter the advantage of the firm with capital as against the firm without it, but it would make these distinctions no more marked than they are at present, and might remedy some of the existing evils.

No details of the plan have been discussed, and I expect to be "jumped on" by many, with details conclusively showing that the scheme will not work, so will stop and wait for them to jump

Fred H. Colvin.

Worcester, Mass.

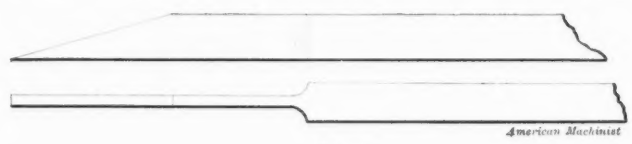


Fig. 3

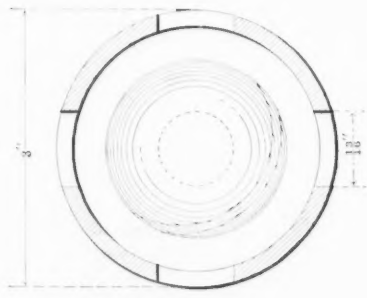


Fig. 2

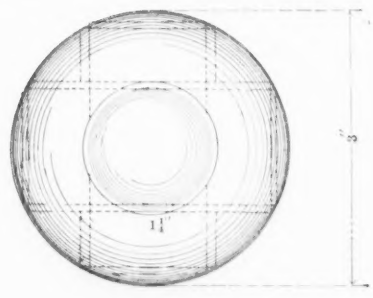


Fig. 1

Examples in Wood-turning.

Examples in Wood-turning.

Editor American Machinist:

In your issue of February 2d, current volume, an article from Chas. W. Heald, headed "A Wood-turning Exercise," was read by me (and no doubt by many others) with interest; and as that gentleman says it is a problem and exercise for manual train-

ing schools, I thought I would send the annexed sketches for the same purpose.

Fig. 1 is a ball of cherry 3″ diameter, divided on the equator into four divisions, and the "poles" found, viz., two centers at right angles to the plane of four centers; then the ball is placed in a cup chuck, and a small parting tool is made to cut a groove in a line with the lathe spindle; treating the six centers the same, the middle piece of six arms will be set loose, but kept in place by the other part of ball.

Fig. 2 is a ball similar to the above, having the same number of centers, but in this case it is a ball within a ball. The inner piece was set free by using the same tool, Fig. 3, and holding it in such a position that it will meet near the center between two adjacent holes after it was liberated. I pared it somewhat near round by holding it between the finger and thumb, and using a small chisel, working through holes. After rounding and smoothing as much as my patience would allow, I painted the inner surface and ball with red paint, using a small camel's-hair pencil.

Visitors invariably appear to be very much interested in them, and most of them try to find the joint in the outer shells, but fail, of course. WM. NEWTON.

Mechanics as a Fine Art.

Editor American Machinist:

The AMERICAN MACHINIST of March 9, 1893, gives an abstract of a paper by Prof. Wm. T. Magruder, which is said to be a "plea for the free use of the imagination and of the beautiful in structures and machines." This abstract is printed on the first page of the paper, and partly surrounds a large cut of Dietz, Gang & Co.'s radial driller, a purely fortuitous combination, which is, nevertheless, pregnant with profound significance, as I shall specify later.

Prof. Magruder wants more "imagination" and more of the "beautiful" in machine design. Machine design is chaos if not exact. Let us be exact in dealing with Prof. Magruder's effort. "Imagination" is neither more nor less than invention; just simply that and nothing else. The large dictionaries give several columns of the AMERICAN MACHINIST's space to elaborations of this definition, but the whole may be correctly summed up in the one word "invention," which again is simply the result, the product, of the exercise of the creative powers of the intellect.

What is the mental process of machine designing? First, the designer, who is not a mere copyist, makes himself familiar with the state of the art, the past of his subject; next, by the exercise of imagination he makes himself aware of so much as may be of the possible future of his subject; he passes before his mind's eye all possible forms and modifications of his subject which his imagination can give him; from all of these pictures he selects such as seem most suitable to his needs, and compares them carefully, laboriously, and often with great difficulty decides upon one of these imaginations as more to his purpose than any other. This becomes his invention, his final design. What I here assert cannot be denied, and the standing of the designer is exactly proportionate to the scope and grasp of his imagination. If his imagination is only able to furnish pictures of what his eye has seen, he is a "safe" or "conservative" man, one who does not set rivers afire, and at the same time does not make hazardous ventures into the realms of the unknown and untried, which may be epoch-making successes or crazy failures.

But if the designer's imagination be wide, full and original, furnishing new forms and undreamed combinations, and is joined with the power to select and compare with discrimination and sound judgment, his work reaches the dignity of true creation. Watt, with the separate condenser; Morse, with the electric dot and dash; Ericsson, with the screw propeller, give well-known examples of seemingly simple efforts of the imagination which made steps in the progress of our race from the condition of small and weak animals to the proud eminence of the magicians of the Arabian Night's Tales, lords of time and space, and the hidden forces of the universe.

Clearly, then, Prof. Magruder's plea for more "imagination" is precisely equivalent to asking for more speed in a race horse, more usquebaugh in the bottle, or more money in his purse, and is perfectly correct, since imagination, and imagination only, can make new machine designs.

But Prof. Magruder does not limit his demand to imagination; he adds, "and a sense of the beautiful" to his desirable ingredients for the mental constitution of the machine designer. Let us examine this.

Beauty is from the Italian and French, and is defined as "that assemblage of graces or proportion of parts, which produces a certain agreeable emotion or feeling, or which pleases the senses, especially the eye and the ear." Beauty in machine design, then, must be simply that which makes the product agreeable to the eye, since all of the efforts of the designer are exercised to prevent noise in machine operation, and hence machine design can please the ear only in a negative sense, by the absence of sound.

Here I must accuse Professor Magruder of indefiniteness and want of precise statement. He says the machine designer, "having determined his outlines by a study of the requirements of his problem, having worked by calculation from the rules of the arts, the form, size and strength of its various parts, he has but completed the demands made upon him by a utilitarian age and the exigences of business competition. To . . . . build a machine . . . . that while it may be in accord with all the rules of the art, yet offends the eye, and does not appeal to our sense of beauty . . . . is to take a step backward in our civilization, and to lose an opportunity to expand one's own mind."

Here is the milk in Prof. Magruder's cocoanut. A machine may be correct in every outline, and still may be ugly and offensive to the eye, and a step backward in machine civilization, the professor says; and yet he does not give the vaguest hint of what is to be added to or subtracted from the crass monster to make it reach to the esthetic symphony demanded by some subtle finer sense, which is beyond, above and superior to all the rules of machine design and mechanical efficiency. I am aware that "esthetic symphony" is not quite the correct thing in words, but the professor's demand reaches outside of the domain of existing language, and a fellow must do the best he can until the English vocabulary grows up to the new idea. Clearly we are here in danger of finding our road dwindle like that western thoroughfare which passed from a wagon track to a cow path, changed to a squirrel track, and ran up a tree. Let us turn from such gauzy abstractions to the refreshing concrete certainties of the Dietz & Gang radial drill, on the first page of the AMERICAN MACHINIST of March 9.

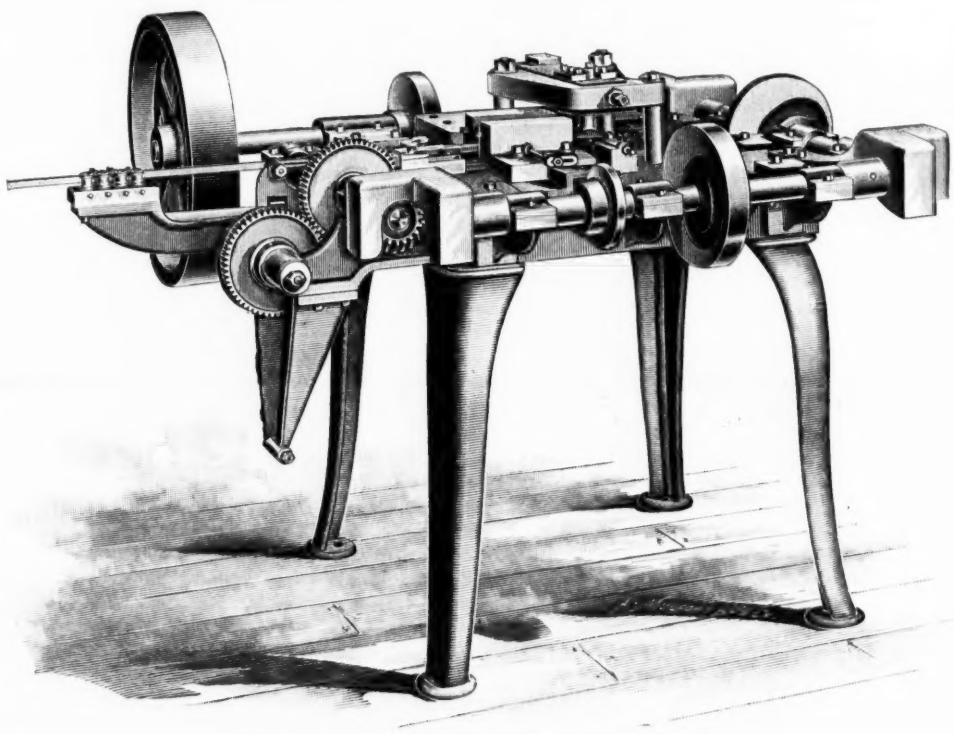
Is it ugly? Is it beautiful? There is certainly not the slightest suggestion of ornament about it. Compared with the figure of a young woman, a galloping horse, a crouching lion, or a lotus in bloom, or an eagle in flight, it doesn't seem to have any lines of beauty to speak of. Must we then vote it "a step backward in our civilization"?

Probably Dietz & Gang would enter a vigorous negative to such a proposition, and for that matter, so should I.

The sense of beauty is a matter not of individual taste, but of race education. There was a day of American machine design, not so long past that surviving examples may not yet be found, when the eye of the designer had not been educated to the supreme beauty of use. We put eagles and pumpkins and melons and bunches of grapes on our steam engine frames right here in New York. We designed our machine tools in "pure Tuscan," or at least one man claimed his drillers were so designed; we put moldings and beads everywhere we could, and we painted our machines green and striped them with red, and refused to change to lead color because it was "ugly."

When we look back on the not yet wholly past of crooked pulley arms, and sprawling machine tool legs, we are moved to speculate as to whether the striving after grace and the beautiful in machine work is not really the result of ignorance lingering in the lap of correct thought, the eagle's feathers in the scalplock of the brave who walks down Broadway, so to speak.

No, no. A thousand times no. Dietz & Gang, without one line, one quirk, one curlicue of "beauty" in their driller, are right, dead right, and Professor Magruder is wrong, until he can tell us where to add to or take from the lovely outlines of pure use, pure practical efficiency of this driller to make it more beautiful to the eye of the pattern maker, the molder, the machinist, or the man who uses it. Professor Magruder cannot do this. He cannot make one single suggestion towards beautifying the work of Dietz & Gang. He is wrong. If not wrong, let him say why. EASY WAY.



AUTOMATIC PUNCHING AND FORMING MACHINE.

Finding Clearance in Cylinders—A "Leetle" Too Much Lead.

Editor American Machinist:

In your issue of March 30th I read a suggestion of R. B. Owens as to how to find the amount of clearance in a steam cylinder. He says: Drill and tap a small hole in each head; then throw the engine on her front and back centers; then measure through the hole to the piston; then deduct the thickness of the head, and the balance will be the amount of the clearance there will be between the head and the piston. Then another way, by taking the cylinder heads off and measuring them. I would suggest a much more simple way: Disconnect the back end of the main rod from the crosshead; push the crosshead back until it strikes the back head; then make a small prick punch or chisel mark on the crosshead guide at the extreme travel of the crosshead; then pull it forward until the piston strikes the front head, and repeat. Connect up the main rod, pinch the engine onto her back center and note how near the crosshead comes to the mark made on the guide; repeat the same thing on the front end, and note the difference of travel of the crosshead between the two marks. This is a thing that every engineer ought to know, so that in filing his brasses as they become worn he will know which side of the crank-pin he ought to put his liner in, otherwise he may knock out a cylinder head.

Another article in the same number by H. P. Clark, entitled "A Leetle too Tight," puts me in mind of a very similar occurrence, only this was a "leetle" too much lead. It used to fall to my lot, while in the employ of a railroad company, in the machine department, to set the valves of the engines. While doing this on one particular engine the engineer that run it came to me and said, "Now, Ben, I want you to give that engine a quarter of an inch lead." I said that would never do; but he said, "That is what I want; it makes her more lively, and I can get away from a station quicker." I said I would not do it, but if he wanted to run his chances on it I would go into the pit and move the eccentric until he thought he had enough lead. I did this, then I tightened up the eccentrics and let her go. Now this man was formerly a master mechanic in the shop, and I felt like respecting his wishes. However, the first trip he made he pulled off a drive wheel—in fact broke the shaft off close to the driving box. When the engine came into the house on three wheels I went to the engineer and said, "Archie, what about that quarter of an inch lead?" He replied, "Ben, for God's sake, don't say anything about that," and I did not.

BENJ. F. HETHERINGTON.
Indianapolis, Ind.

Automatic Punching and Forming Machine.

We present herewith an illustration of a machine adapted for punching, bending and forming flat wire and narrow strips of sheet metal, which it takes from the coil, straightens, cuts off into suitable lengths up to 8 inches, and any desired ornamental end, punches with any desired number of holes and bends to shape.

This is done automatically, by means of suitable plungers moved in towards the former from the four sides of the machine, the motions for them being derived from cams placed upon the shafts which are seen surrounding the machine, and which are driven from the one driving pulley by means of bevel gears.

The arrangement of the machine is such that the form or proportions of the piece made by it are readily altered, and it is adapted to a wide variety of work within its range, which is for pieces up to 8 inches long, ⅝ inch wide and .055 inch thick. The brackets used to support curtain poles are fairly representative of the work the machine is designed to do. It occupies a floor space of 50x55 inches and weighs about 1,500 pounds. It was designed by F. B. Manville and is made by Blake & Johnson, Waterbury, Conn.

By an error in transcribing, in our issue of last week, we located the Penberthy Injector Company at New Albany, Indiana, instead of, as we should, at Detroit, Michigan. New Albany is the place of business of the expert who made the test of their injector.

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Fred J. Miller, } Associates.

Special Announcements.

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Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.

We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.

We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.

Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.

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NEW YORK, APRIL 20, 1893.

CONTENTS.

	PAGE.
Hydraulic Portable Riveting Machine	1, 2
Molding by Machinery—Foundry Appliances, Etc. By S. Bolland.	3,
A New Crank Shaper	4, 5
String Routing Machine	5
Letters from Practical Men: The Ann Arbor Decision. By R. D. O. Smith .. A Question. By Greko....Steel for Cams. By J. C . Cams and Cam Rollers. By John T. Hawkins.... Measurement of Irregular Surfaces. By W. H. Croker .. Clippings and Note-books. By Fred. H. Colvin ..Examples in Wood-turning. By Wm. Newton....Mechanics as a Fine Art. By Easy Way... Finding Clearance in Cylinders—A "Leetle" Too Much Lead. By Benj. F. Hetherington..	5, 6, 7
Automatic Punching and Forming Machine	7
Engineers and Mechanics	8
Defining Rights	8
Literary Notes	8
Questions and Answers	8, 9
Columbian Exposition Notes	9, 10
Manufactures	10
Machinists' Supplies and Iron	10

Engineers and Mechanics.

Director of Works Burnham, of the Chicago Fair, is reported to have said at a dinner in New York: . . . "In the last decade or two one could go out on the streets of a great city and collect a force of engineers and draftsmen very much as formerly he hired mechanics."

Mr. Burnham stated a fact in this, but the fact to which we refer would hardly be covered by the impression he evidently intended to make. We think it was scarcely what he would have said had he given a little previous thought to definition. If it is true, as he evidently meant it to be understood, that engineers are so plentiful that they can be picked up, lying about loose as it were, then it is bad for engineers that, as Mr. Burnham puts it, "The times have multiplied the corps of trained technical men," to such an extent. For when men in any vocation are as plentiful as we should understand engineers to be, if we took what he said without allowance, they must work for small pay, jostling one another out of place and dignity in their eagerness for a job.

We have no doubt one could "go out on the streets of a great city," just as Mr. Burnham intimated, and find any number of men who would be willing to accept the title of engineer—and reasonable wages. But accepting the title, or pushing it forward, or having it thrust upon them does not make them engineers. If Mr. Burnham had said he could have hired so-called engineers by the thousand there would have been no ground for dissenting; but when it comes to hiring real engineers, we must believe either that he has peculiar aptness for that kind of business, or that he is not very rigid in his application of the title.

The great majority of men find it just about as difficult to get good engineers now as ever. It is just as difficult as it is to find good doctors or good lawyers—every bit of it. If Mr. Burnham had wanted a thousand or two men of either of the last-named professions he would not have had the least difficulty in finding them, diplomas and all. But if he wanted a good doctor or lawyer it might not be easy to find him at liberty. And this is about the case with engineers. There is, in the instance of all three of the professions, too many who hold their rank by title only.

What is true of engineers, or draftsmen if a distinction is made between them, is equally true of mechanics. There never were very many really competent men of either class loose about the streets of great or small cities, waiting for something to "turn up." The demand is always a little greater than the supply, and is always likely to be. This is a stubborn fact. The standard may be undergoing a constant process of elevation; but the fact will remain. In this connection reference may be had to a paper read before the A. S. M. E. by Mr. H. F. J. Porter at the New York meeting. Mr. Porter's views may be studied with profit.

Mr. Burnham's remark is hardly to be taken literally, or, perhaps, it should be taken exactly literally, even against his meaning. He could probably find *real* engineers and draftsmen waiting around loose just about as easily as he could find *good* mechanics. Just about we should say.

Defining Rights.

Court decisions bearing upon the relations existing between employers and employed follow each other thick and fast in these days, and it looks as if no one could tell where they will end.

The decision of the Ann Arbor cases applies only to interstate commerce traffic, and does not probably in any way affect any other or those engaged in any other.

The same is probably true to a great extent of the decision by Judge Speer directing the receiver of the Central Railroad of Georgia to recognize and enter into a formal agreement with the Brotherhood of Locomotive Engineers for service on that road, though in this case it is manifestly of great importance to the engineers, because practically all of them are engaged in interstate commerce, and it gives their organization a recognized and respectable standing in the courts, imposing upon it at the same time the responsibilities that naturally accompany this standing.

Here in New York a decision has been rendered that seems to be significant, and to have some bearing upon such matters as black lists, etc.

The cheap clothing manufacturers and their workmen are mostly foreigners and are almost perpetually at war. For some reason which does not appear very plainly, the manufacturers combined and agreed to dismiss all union workmen. They did this, and the workmen issued circulars asking people not to patronize the manufacturers. Thereupon the manufacturers went into court and asked that an injunction be issued to stop this boycotting. Judge Barrett, before whom the case was tried, seems to have gone into the matter of a cross examination on his own account and to have brought out the fact that the action of the manufacturers was nothing more nor less than a conspiracy against the men, and that their asking an injunction was for the purpose of depriving the men of their "only available weapon," as the judge put it. He refused the injunction, which seems to imply that when employers combine to deprive workmen of a chance to work, the workmen can ask other people not to patronize the combined manufacturers without laying themselves liable to the law.

This appeal to the courts in such matters is much to be preferred to more violent methods, and a line of decisions will eventually define the respective rights and limitations of both sides, after which the legislative power can be appealed to, and probably with success, to correct remaining abuses.

The respective rights and privileges of employer and employe are much better settled and understood in older countries than here. And it is desirable they should be clearly defined and understood.

A year or more ago we noted the fact that Mr. Chas. W. Sponsel, of Hartford, Conn., had devised a new rapid-fire gun that possessed several advantages over the Hotchkiss and other guns of similar type. Mr. Sponsel's gun has been subjected to several firing tests recently, the latest by the Navy Department, and the result has been very favorable, the probability being that the gun will be adopted and manufactured for the navy by the Pratt & Whitney Company.

Mr. Sponsel has done something that is analogous to what very many mechanics have the opportunity to do, *i. e.*, while attending to his duties as assistant superintendent of the gun department at Pratt & Whitney's, where it was part of his business to devise tools and methods of manufacture of the Hotchkiss gun, he has used his spare time in devising a gun which avoids most of the peculiar difficulties of manufacture and the defects of the older gun, reducing very materially the number of parts, and the cost of manufacture, at the same time improving the action of the gun.

It now looks as if the employment of prisoners in roadmaking was to be quite comprehensively tried in the State of New York, the Governor, it is understood, favoring the trial. We have always advocated this disposition of prison labor as far as practicable. There are many things in its favor. It will aid in securing good roads, which is something very much needed in this country. Such employment of prison labor will not interfere with free labor, because it will, in the main, be employed on work that would not otherwise be done. Another consideration, and probably not the least, is the employment will be a healthy one, and that is a great aid in the reformation of criminals. We hope, by all means, that the State will give it a fair trial.

Some surprise is manifested at the fact that, though the method of determining the speed of vessels introduced by Commodore Melville, and used in the trial of the "Bancroft," proved entirely satisfactory so far as known in every way, it seems to have been abandoned for a return to the old method, which involves a continuous run over a long course marked by anchored vessels. The ordinary plain every-day engineer would be apt to conclude that the standardized screw method is the best one for determining the speed of a vessel, and would be apt to use it in preference to any other, but, then, perhaps engineers have little or nothing to say in deciding what system of speed trials shall be employed by the navy.

Literary Notes.

BUILDING AND STRUCTURES OF AMERICAN RAILROADS. A reference book for railroad managers, superintendents, master mechanics, engineers, architects, and students. By Walter G. Berg, C. E., principal assistant engineer, Lehigh Valley Railroad.

This book is another valuable contribution to the technical literature of the day, and contains important information, data, and valuable plans of structures, which would be very difficult to obtain in any other way. Its scope embraces a large variety of buildings, particularly the smaller ones connected with the roadway and operating departments, the cheap and simple structures in use in the thinly settled sections of the country being considered of as much importance as those of the most elaborate and artistic designs. The different chapters deal with the following subjects: Watchman's shanties; section tool houses; section houses; dwelling houses for employes; sleeping quarters, reading rooms, and club houses for employes; snow sheds and protection sheds for mountain slides; signal towers; car sheds and car-cleaning yards; ash-pits; ice houses; sand-houses; oil-storage houses; oil-mixing houses; water stations; coaling stations for locomotives; engine houses; freight houses; platforms, platform sheds, and shelters; combination depots; flag depots; local passenger depots; terminal passenger depots. The appendix contains various specifications for depots, engine houses, etc.

Each subject is discussed in a general manner at the beginning of the corresponding chapter, so that inexperienced persons can gain information on the salient points and controlling features for each class of structures. The second part of each chapter is devoted to detail descriptions and illustrations of structures in use on American railroads.

Over five hundred different buildings and structures, embodying the best practice for each particular class, are described or referred to, accompanied by nearly seven hundred illustrations. Many of the subjects embraced in this book have not before been discussed in print in a systematic manner, and the information conveyed will be of great aid to railroad men, and, in many cases, may obviate the necessity of making tedious investigations and personal inquiries. The book is published by John Wiley & Sons, 53 East Tenth street, New York. Price, $7.50.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(185) G. H. W., Worcester, Mass., writes: Is there a good correspondence school for mechanics? I wish to take a course of studies in geometry, trigonometry, mechanics, etc. *A.*—Write to the Correspondence School of Mechanics, Scranton, Pa.

(186) C. W. P., Peabody, Mass., writes: Please inform me of the title of a book, and where it can be obtained, which treats most thoroughly and in a practical manner on millwright work in all its branches. *A.*—We have not seen a book of this kind.

(187) J. M. W., Franklin, Pa., writes: Please inform me how to make conical spiral springs, such as are used on steam pump valves. I have used a conical mandrel with grooves cut on it and then wound the wire around it, but with very uncertain success. *A.*—We know of no better way than you have adopted.

(188) J. C. M., Lancaster, Pa., writes: Please inform me where the Belleville boilers, mentioned in your paper, are manufactured, or give me the patentee's address. *A.*—The Belleville boiler we believe to be a French invention; its sale is controlled in this country by Miers Coryell, M. E., 21 East Twenty-first street, New York.

(189) J. D., Philadelphia, Pa., writes: Please inform me what size boat can be driven by an engine 2x3 inches making 400 revolutions per minute, steam pressure 100 pounds. *A.*—Length, 18 feet; breadth outside, 4 feet 6 inches; depth, 2 feet. 2. What size propeller will be required? *A.*—12 inches diameter, 21 pitch. 3. What speed do you think that I can obtain? *A*—From 6 to 7 miles per hour.

(190) M. F. L., Tremont, Pa., writes: We have a 1-inch steam pipe leading to a steam pump, and run it at the rate of 60 strokes per minute with a steam pressure of 70 pounds in the boiler. Can I accelerate the speed of pump by increasing the size of pipe at pump to 2 inches for a distance of 30 feet, the balance of the steam pipe to boiler to remain 1 inch and the pressure in the boiler remaining 70 pounds? *A.*—Increasing the steam pipe as you propose to do will increase the speed of pump, under the assumption that the 1-inch pipe is rather small for the work. The steam pipe should be well covered to prevent condensation.

(191) C. E. B., Richmond, Ind., asks: Is there a paper published in your city called the *Optician?* If so, what is the correct address? *A.*—The *Optician* is issued every month, and is published at 18 Liberty street, New York. 2. Can you recommend the course of study in the correspondence school at Scranton, Pa., as really practical and worth the time to complete it? *A.*—We have heard it well spoken of, and believe the course of study to be a good one. 3. Is the school chartered, and what is the value of its diploma compared with other mechanical school course? *A.*—Write to the institution for this information.

(192) E. G. H., New York, writes: Kindly inform me as to the best modern practice of coppering and brassing all kinds of iron and steel stampings without the aid of electricity. I intend to put down a plant to handle about 500 pounds of stampings (small hardware) every day, and should like to know what is required for a quick and economical operating process. *A.*—This is out of our line, and we therefore do not consider ourselves sufficiently well informed to advise you correctly. The best way to get this information is to observe the process used by other manufacturers, or engage the services of a practical man thoroughly experienced in this class of work.

(193) E. C., Chicago, Ill, writes: Please let me know if there is a pickle or brine in which cast-iron can be made soft, and of what it is composed. Also what is the best way to remove rust from wrought iron screws? *A.*—A pickle for softening the surface of cast-iron is composed of 1 part aqua-fortis to 4 parts of water, the castings to be immersed therein about 24 hours. Rust may be removed from wrought-iron by immersing in a bath composed of 1 pint muriatic acid to 1 quart water for 24 hours. Cleanse the articles from all grease with a hot solution of soda before immersing, and in clean water after. The rust comes off like dirt by scrubbing with soap.

(194) H. G. M., Grand Rapids, Mich., asks: Is it possible to make open hearth castings or any kind of steel castings of large size, say 2 tons, so that they cannot be machined? Would what is known as manganese steel be the thing? *A.*—We referred these questions to S. Bolland, who replies as follows: What is known as "manganese steel" contains manganese, 1.10; carbon, .31; silicon, .06, and would not be likely to produce castings of sufficient hardness to resist machining. But "tungsten steel" containing 10 per cent. tungsten, .31 per cent. carbon, and .06 per cent. silicon would probably answer, as the hardness of steel is increased almost indefinitely by the addition of this alloy. The tungsten is used as a triple manganese alloy, prepared like ferromanganese, or, as a crude, fritted metallic tungsten, obtained by reducing wolfram with a mixture of coal and tar, etc.

(195) X. Y., New York, writes: I have in use four cylinders 7 inches diameter with a stroke 4 feet; the piston rod is 2 inches in diameter. These are used as pulling jacks upon a carriage, one at each corner, to lift together a maximum load of ten tons. Can I use a 5-inch trunk in place of the 2 inch piston rod, and so displace some of the liquid, retaining the same pump; or what size pump must I have to reduce the time $\frac{2}{3}$, namely, diameter of plunger, stroke, and length of lever? I should like to know how to calculate such problems. *A.*—We see no use of increasing the diameter of the 2 inch piston rods. To reduce the time of lifting the weight you will require a pump of larger capacity; but we cannot give the size of the pump without knowing the time that the load must be lifted; you have simply given the reduction of time, and omitted stating the original time.

(196) L. J. F., Ausable Forks, N. Y., writes: I am going to build a wooden conductor in the ordinary way with staves and wrought-iron bands; it will be 500 feet long and 6 inches in diameter. What I desire to know is, which is most likely to freeze, an iron or a wooden one? I cannot cover it easily with dirt; is there any way to prevent freezing? Please give me the desired information. *A.*—There is practically very little difference in the freezing capabilities of the two conductors; the wooden one will probably not be so liable to freeze as the iron one. Either should be well covered with asbestos, and, if possible, a swift current should be maintained in it during cold weather. 2. Do you think it is advisable to build a timber dam? There is a good solid edge on both sides of the stream; our superintendent thinks a timber dam will answer the purpose. *A.*—We see no objection to it.

(197) O. L., Granite Falls, Minn., writes: I am running an electric light plant. We have two horizontal tubular boilers 54 inches diameter, and 14 feet long with 2-inch blow-off at back ends as usual. The inspector recommended to make connection from blow-off to top of water level, so as to make a circulation through same, and prevent the mud from lodging in the blow-off. The only way to make such a connection would be to bring the pipes to front end and connect with water column. Now I cannot see how that would set up any circulation. Please give me your opinion. *A.*—We do not see any necessity for running the pipes to the front of the boiler, the pipes can be run from the blow-off to the back heads. We know engineers who have connected the blow-off to the back head just below the water level, and claim to have obtained good results.

(198) C. A. C., Buffalo, N. Y., writes: A vertical pipe 27 inches diameter and 30 feet high supplies the requisite amount of water to a turbine, which amount of water we will suppose to be 500 cubic feet per minute. What should be the diameter of a horizontal pipe which conveys the water to the upper end of the vertical pipe? The horizontal pipe will be 150 feet long and cannot have a bend to connect with vertical pipe; the angle must be abrupt. I have my own ideas of the diameter, but should like your views and manner of computing for the least diameter, so as to have no more loss of head than there is in the vertical pipe. *A.*—For computing this diameter we should have the total head, which you have not given. You need not fear of increasing the friction by making the diameter of the horizontal pipe too large, as one of the laws of friction of the flow of water in pipes is: The friction decreases as the diameter of the pipe increases.

(199) F. N. P., Brantford, Canada, writes: Kindly inform me how I can successfully cast an anvil about 18 inches long, 12 inches wide, and about 7 or 8 inches thick, chilled on top surface. It will be necessary to grind these smooth after chilling, so that the surface must be solid, and it should be chilled in, probably 1 inch at least. *A.*—To cast such an anvil block, let the face side be cast downwards upon a chill, made of good, strong and close cast iron in which the carbon is largely combined. This chill ought to be at least 6 inches thick, and the face side should be finished smooth, and rubbed over with blacklead having a slight admixture of oil, before the mold is cast. Use car-wheel scrap, such as shows a deep chill on the thread, or obtain No. 3 iron, containing about 2 per cent. carbon, that is slightly mottled, and shows a bright gray fracture with very fine grains. The addition of scrap steel or spiegeleisen increases the depth of chill. For further information on this subject see 'Chilled Castings" in the *Iron Founder*, and 'Car Wheels" by S. Bolland, in the AMERICAN MACHINIST, December 15, 1892.

(200) Clerk, Chicago, Ill., writes: Some time ago an eastern firm erected in the store in which I am working a pneumatic plant. While in the course of construction, I asked one of the men these questions: Is the pressure at the blower the same as it is at the other end of the line? And is the speed of the carrier at the salesman's end the same as at the cashier's end? To both of these questions he said that there was no difference. I am of the opinion that there must be a difference on account of the friction. Please let me know if I am right or wrong. *A.*—There will be a slight difference in the pressure due to friction; there may be, or there may not be a difference in speed, as this depends on the position of the tracks, whether these have been laid horizontally or not. The differences in pressure and speed of carriers are probably so slight, that for all practical purposes the answers given by the man are correct.

(201) E. B. D., Cortland, Ind., asks: How many steam engines of all kinds, sizes and types are there supposed to be in the United States? What is the supposed horse-power of all these engines? I have figured a little on this, and I made the following estimate or guess:

Number of locomotives.....	30,000
Number of portable engines..	70,000
Number of stationary engines..	200,000
Total.....	300,000

giving a total of 20,000,000 horse-power. This includes all kinds and sizes of engines both on land and water. What do you think of this guess? *A.*—The number of locomotives is about correct, but we are not prepared to express an opinion in regard to the number of other kinds of engines. 2. I also estimated the fuel at 5 cents per horse-power per day. Is this too large or too small? *A.*—We believe this to be a fair average.

(202) F. H., Columbia, O., writes: On page 90, part II, of Prof. Unwin's "Elements of Machine Design," I find the formula for counterbalancing vertical engines to be:

$$W_1 = W_2 \frac{r}{p}; \qquad (1)$$

in which W_1 denotes the weight of the balance weight and p the radius to its center of gravity, W_2 the weight of the crank pin and half the weight of the connecting rod. For horizontal engines:

$$W_1 = \tfrac{3}{8}(W_2 + W_3)\frac{r}{p} \text{ to } \tfrac{3}{4}(W_2 + W_3)\frac{r}{p} \qquad (2)$$

is given, in which W_3 denotes the weight of the piston, piston rod, crosshead, and the other half of the weight of the connecting rod. Is this right or have the formulas been reversed? *A.*—For horizontal engines formula (2) is often used; formula (1) will give a counterbalance too light for vertical engines. We should use formula (2) for computing the counterbalance for both horizontal and vertical engines, excepting locomotives, in which the counterbalance should be heavier. The counterbalance should be determined, in part at least, by the character of the foundation. The shaking forces should be made principally vertical for a very solid or tall foundation; in other cases the light weight and horizontal efforts may be demanded.

(203) A. A. P., Syracuse, N. Y., writes: I wish to proportion a pair of gear wheels; the wheel is to make 40 revolutions per minute, and the pinion 120 revolutions per minute; the load will be about constant. I have looked through books, but somehow I do not get the idea, probably because I have never undertaken anything of this kind before. The distance between the centers of gears is to be 20 inches. What sticks me is the thickness of the tooth on the pitch line, also the width of face of wheel. Kindly help me out. *A.*—The first step will be to find the radii of the pitch circles of the wheel and pinion as follows: Multiply the distance between the centers of the wheel and pinion by the number of revolutions of the wheel, and divide the product by the sum of the revolutions of the wheel and pinion; the quotient will be the radius of the pitch circle of the pinion; hence we have:

$$\frac{20 \times 40}{160} = 5 \text{ inches for the radius of the}$$

pinion, and $20 - 5 = 15$ inches for the radius of the wheel. The same result could have been obtained by multiplying the distance between the centers by the number of revolutions of the pinion, and dividing this product by 160 as before, thus:

$$\frac{20 \times 120}{160} = 15 \text{ inches for the radius of}$$

the wheel and $20 - 15 = 5$ inches for the radius of the pinion. The next step will be to find the pitch. This will depend on the pressure on the teeth and the width of the face of wheel. In ordinary cast-iron mill gearing, the width of face is $2\frac{1}{2}$ times the pitch. For this proportion we have, for finding the pitch, the following formula:

$$p = .0447\sqrt{P};$$

in which p denotes the pitch in inches and P the pressure in pounds on the teeth. Let the pressure P on the teeth be 500 pounds; we have then for the pitch:

$$p = .0447 \times \sqrt{500} = .999,$$

say 1 inch. We have found the diameter of the pitch circle of the pinion to be 10 inches, the corresponding circumference is 31.416 inches; this shows that by increasing the pitch to 1.0134 inch, we can get 31 teeth in the pinion. The pitch circle of the wheel is 30 inches diameter, the corresponding circumference is 94.248 inches; if now on this circumference we lay off the pitch 1.0134, we find that we can get 93 teeth on the wheel. This gives 3 times as many teeth on the wheel as there are on the pinion; this is as it should be, because the pinion makes 3 times as many revolutions per minute as the wheel. The thickness of the tooth on the pitch line for cast gears is usually equal to .48 of the pitch, hence in this case the thickness of the teeth on the pitch line will be $1.0134 \times .48 = .486$ inch. The formula $p = .0447\sqrt{P}$ is suitable for a face equal to $2\frac{1}{2}$ times the pitch; if this proportion of face to pitch is changed, the constant .0447 should also be changed; thus, for $\frac{\text{face}}{\text{pitch}} = 2$ use .05 instead of .0447; for $\frac{\text{face}}{\text{pitch}} = 2\frac{1}{4}$ use .0475; for $\frac{\text{face}}{\text{pitch}} = 3$ use .0408, and for $\frac{\text{face}}{\text{pitch}} = 3\frac{1}{2}$ use .0378. If the teeth are subjected to great shocks, the pitch as found above should be increased.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gears. Lexington and Phila See page 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes Mer. Mach Tool Co., Meriden, Ct.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St, N. Y.

Selden Packing for stuffing box, with or without rubber core Randolph Brandt, 38 Cortlandt St., N. Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Engine Castings. Humphrey's Foundry, Bellefontaine, O.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

Factory sites given away, 1 hour from New York. Address R. V. Pierce, Bound Brook, N. J.

"Pumping Machinery." New book, 450 pp. 8vo, 270 Eng. Prospectus free. W. M. Barr, 3223 Powelton Avenue, Philadelphia, Pa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt Newark, N. J.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg Co., corner Canal and Washington Sts., Chicago, Ill.

Combination, duplex and special gear cutters in stock and to order. vertical milling machines. R. M. Cloagh, Tolland, Conn.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Columbian Exposition Notes.

INJECTORS.

Manufacturers of injectors will be given an excellent opportunity to put their machines to practical use. Besides having feed pumps, all the boilers will be supplied with injectors. They will be placed on the front of the visitors' gallery—just to the side of the feed pumps, and will be connected to the same supply, feed and steam pipes as the latter. Headers of 4" pipe for each set of injectors for steam, supply, feed and waste are hung snug against the wall of the visitors' gallery, and the injectors are cross-connected between them by a neat system of piping.

Although injectors have not been chosen for all the boilers, a partial list can be given at

this time: For National boilers, four Hayden & Derby; for Babcock & Wilcox, five Hancock; for the Root, six N. A. Watson; for the Campbell & Zell, six from the Nathan Mfg. Co.; for the Stirling, six Schaffer & Buđenburg's "Peerless." Eight Penberthy injectors will feed the Heine boilers. These last are gold and silver-plated—a good thing, no doubt, but somewhat of an extravagance when the gold and silver of these cannot be distinguished from the brass and nickel of the others. The Rue injectors will probably feed the Gill boilers, though the number has not been settled yet.

All the above go in the boiler house proper. There will also be three Sellers injectors, which are not located as yet.

BOILERS.

It will, no doubt, be a surprise to many to see the Stirling placed among the boilers of the boiler house proper. In a former letter it was stated that the Babcock & Wilcox Co. had an injunction, preventing the Stirling Company from placing their boilers next to their own. This injunction was being contested in the courts at that time. The courts shortly afterward decided in favor of the Stirling Co., and they immediately began erecting their boilers. Their work is well under way.

Foundations are about completed for the boilers in the boiler house extension. They are located as follows: At the east end are two batteries of Heine aggregating 2,000 horse-power. Next to these are the Climax (vertical tubular), two of 500 horse-power, and a 1,000 horse-power between them. Then follows one Stirling battery of 800 horse-power. This leaves a space of about 50 feet at the extreme west for which boilers have not been chosen.

FEED PUMPS.

The Stirling boilers in the boiler house proper are fed by two Buffalo duplex pumps, a 10″x6″x10″, and a 7½″x5″x8″, and by a Gould 10″x12″ triplex pump geared to an Ideal (A. L. Ide & Son) 9″x12″ engine.

The Heine boilers in the extension have two 10″x6″x12″ Marsh (Battle Creek Co) pumps. The Climax have one Blakeslee 10″x6″x14″ duplex, and one Smedley 12″x7″x15″ duplex, and the Stirling, one Hall 8″x5″x10″ duplex, and one McGowan 8″x5½″x10″.

EXHIBITORS' HEADER

A header for supplying steam to exhibitors throughout Machinery Hall and annex is now being erected. It is of 16″ standard wrought-iron pipe, and extends the length of the building down the east and west central aisle, just under the floor. Tees with 6″ outlets are placed at frequent intervals for branch connections. This header is fed by six 8″ pipes connecting from as many different points in the main 36″ header.

STEAM PIPE TO THE CASINO.

A steam line from the Machinery Hall to the Casino on the lake shore, 2,350 feet long, has just been completed. It will be tested shortly. This line is of 6″ pipe, and lagged throughout with asbestos paper and rainbow lagging. There are seven water pockets in its length, made by turning down by a 6″ ell into one of the straight openings of a 6″ tee. The line is continued from the side opening, while a short piece of pipe on the other end of the straight forms the water pocket. These pockets are usually placed where bends come in the pipe, and as all the fittings are threaded, they form excellent expansion joints. The pressure at the boiler house is 125 pounds, and it is expected that 100 pounds will be had at the other end.

Steam will be used at the Casino for running a duplex pump, for a hydraulic elevator, also for a 25 horse-power engine and refrigerating plant for the big restaurant which will be located there.

Steam will also be used in the restaurant for all cooking and heating purposes as far as possible.

Another long steam line is the one from the boiler house to the Mines building. It is about 2,000 feet long, and of 10″ pipe. The steam will be used for driving certain machines in the Mines exhibit.

In our issue of April 6 we illustrated a portable pneumatic tapping, drilling and reaming machine, made by James T. Halsey, of Philadelphia; we said of the machine: "It is essentially a rotary engine." Mr. Halsey writes to say that we made a mistake in this statement; that it is a reciprocating engine. In the matter relating to the tool which we had from Mr. Halsey nothing was said as to the kind of engine that drove the tool, and the cut has the appearance of a rotary engine. We believe that would be the conclusion of those who saw his circular.

The New York *Herald* exploits, with what might by courtesy be called a pictorial representation, a new motor that is, of course, designed to revolutionize motive power in general. The information one gains by reading the article is that the movements of the machine are brought about by the explosion of sugar, potash and sulphuric acid, which, of course, is an easy if not a very lucid explanation. The new motor is to cut the time between here and Europe in two, and, we suppose, do various other things; still the capital stock of the company is only $1,000,000, which is modest at least.

The curve given by Mr. Leicester Allen in our issue of March 9, current volume, for which equations were required, has awakened considerable interest among students. We have published several solutions. Since then we have received one from Nelson B. Hale, Worcester Polytechnic Institute, Worcester, Mass., and several others; these solutions are similar to those already given, and for this reason we deemed it advisable to withhold their publication.

The New Process Raw Hide Co., of Syracuse, N. Y., inform us that they are furnishing either gears or blanks from which gears will be cut, to a number of machinery concerns for use in their exhibits at the World's Columbian Exposition, anything that tends to the suppression of noise being of prime interest there.

Hiram W. Sibley, of Rochester, N. Y., has recently given $50,000 to Cornell University for the erection of an addition to Sibley College. Mr. Sibley's father founded the college, and altogether the family has contributed more than a million dollars to it.

MANUFACTURES

The Belknap Motor Co., Portland, Me., has obtained a re-lease of the entire building at Fore and Cross streets, and will increase capacity.

The Hogan Boiler Company, Middletown, N. Y., is building shops in which to carry on the manufacture of the Hogan high-pressure boiler.

The Pittsburgh Wire Works at Braddock, Pa., have been put on double turn in all departments, giving employment to about 200 additional men.

The Morris & Bascom Manufacturing Company, of Richmond, Va., has been organized to manufacture machinery. J. B. C. Morris is president.

The Eureka Emery Wheel Company, of Buffalo, N. Y., has been organized to manufacture hardware. Capital, $25,000, and directors, M Reish and others.

J. A. Fay & Co., Cincinnati, Ohio, have issued a sheet, for distribution, containing cuts and brief descriptions of a large number of wood-working machines.

The Wm. Roper Manufacturing Company, of Buffalo, N. Y., has been organized with a capital of $20,000, and directors A. W. Olmstead, F. J. Bond and others.

The N. A. & S. H. Burpee Furniture Company has been incorporated in Rockland, Me., for the purpose of manufacturing furniture. S. H. Burpee is president.

Washburn & Moen, Worcester, Mass., will increase the capital stock from $2,500,000 to $3,000,000, in order to enlarge the new plant at Waukegan, Ill.

The Withrow-Breeden Hardware Manufacturing Company, of Neosho, Mo., has been incorporated, capital, $10,000. Incorporators, J. M. Withrow and D. A. Price.

The Queen City Engineering Company, of Buffalo, N. Y., is organized at $10,000, by D. L. Volker and others to manufacture steam pumps, machinery and supplies.

At Louisville, Ky., C. C Mengel, Jr, and C R. Mengel have incorporated the Columbia Veneer and Box Co, to manufacture veneer, boxes, etc. The capital stock is $100,000.

The Automatic Railway Track Saunder Co has been organized at Portland, Me., with President, C. V. Holman, Boston, Mass.; treasurer, F. W. Verrill; clerk, D. C. Verrill.

It is thought that the plant of the South Boston Iron Works, at Middlesborough, Ky., will be ready for occupancy about May 1. The plant will give employment to about 500 hands.

Miner & Peck Manufacturing Co., New Haven, Conn., issue a new catalogue (standard size) of drop lifters drop presses, blast forges and drop forgings. Quite fully illustrated.

There is water-works agitation at Middletown, Ohio; Aurora, Ind.; Portland, Ore.; Van Buren, Ark; Oberlin, O.; Medford, Mass.; Lancaster, O.; Columbus, O; Logan, O.; Gallipolis, O.

The Lynn (Mass.) Gas and Electric Co. is to erect a new power station of brick and iron. The structure will be 150 feet square, costing $150,000 and is to have a capacity of 2,500 horse-power.

The Crescent Steel Works, 480 Pearl street, New York, have issued a new classified price list of Crescent steel of a variety of forms, and for various purposes. It is a very useful little book to have.

The Weisel & Vitter Iron and Machine Mfg. Co., Milwaukee, Wis, will rebuild their plant on a larger scale. The capital stock has been increased to $200,000, and about $75,000 will be expended.

Chandler & Taylor Co, Indianapolis, Ind., issue a catalogue (standard size) of saw mills and sawmill machinery, including engines and boilers. It is printed on good paper, and quite freely illustrated.

A representative of a large carriage manufactory was in Salem, Mass., recently, in conference with President Cousins, of the Board of Trade, looking for a location to remove his business to Salem.

The Caldwell Boiler Co., 15 Cortlandt street, New York, has been awarded an order for 455 horse-power of boilers by the Western Union Telegraph Co., for their large building corner Broadway and Dey street.

It is reported that Fort Scott, Kan., will have a paper-mill. The contract has been closed. The building will be 150x180 feet and will, according to the plans and specifications, cover 8,000 square feet of ground, and will have a capacity of five tons of paper a day.

The Frank-Kneeland Machinery Company has taken out permits to erect new shops at its plant on the Allegheny Valley Railroad, 18th ward, Pittsburgh. They consist of a machine shop to cost $11,000 and a foundry to cost $9,000, both to be of brick and iron.

The Grant Anti-friction Ball Co., Fitchburg, Mass., has issued a catalogue and price list of hardened steel balls. This company manufactures under a new process, and claims to have the largest and best-equipped plant in the world devoted exclusively to the manufacture of balls.

L. S. Starrett, Athol, Mass., has purchased a half interest in F. J. Gay's plant at Providence, R I., for manufacturing milling and forming cutters. Mr. Starrett is building an addition to his present factory, and when this is completed the Providence plant will be removed to Athol.

An Eastern syndicate has secured an option on 5,600 acres of land near Johnstown, Pa., and on which it intends to build a manufacturing town. This tract of land is underlaid with a heavy vein of coal and includes the old Ritter furnace, which it is thought may be remodeled and put in operation.

Messrs. A. C. Johnson, E. Anderson and P. A. Nelson have leased temporary quarters in Fremont, Neb., while their factory is being built. This new concern has been organized for the manufacture of mattresses and upholstered goods. It has an authorized capital of $50,000, and a paid-up capital of $15,000.

The Laidlaw and Dunn Company, of Cincinnati, Ohio, and the Gordon Pump Company, of Hamilton, Ohio, have agreed on terms of consolidation. The business will be carried on by a company to be known as the Laidlaw-Dunn Gordon Company. The capital will be $700,000 Extensions of plant are contemplated.

The F. W. Foster Manufacturing Company has been incorporated at Portland, Me., for the purpose of manufacturing faucets, automatic sprinklers and apparatus used by steam fitters, with $250,000 capital stock. The officers are: President, C. E. Flett, of Melrose, Mass.; treasurer, F. H. Foster, of Melrose, Mass.

The J. T. Case Engine Co., New Britain, Conn., send us a neat illustrated catalogue of steam engines made at the works. These engines are adapted to be used for a great variety of purposes, and are made of forms to suit the different uses. The illustrations clearly show their adaptation, and with the text explains their construction.

Newport, Me., is to have two more new industries. Morse & Crane have purchased a lot and will erect a two-story frame building with basement, for the manufacture of bed and furniture springs, and W. H. Moore, of Hartland, has purchased a lot and will put up thereon a mill for the manufacture of doors, sash, blinds and wood finish.

Business will boom at Milbridge, Me., the coming season. Two sardine factories will be run, and as many lobster factories. Several granite quarries will give employment to many hands, and the usual number of men will be kept busy in the shipyard of J. W. Sawyer & Son. All this will make profitable business for the coastwise shipping of that port.

A combination of the harrow makers is reported. The Standard Harrow Company has been incorporated in New Jersey, with a capital of $2,000,000. Edwin H. Resley, of Utica, N. Y.; Maurice Maes, of New York City, and Gen. Oscar E. Madden, of Boston are among the incorporators. A large factory will be built. Operations are expected to begin about the 1st of July.

It is reported at Rochester, N. Y, that representatives of several large manufacturers of wood-working machinery have met to take steps to form a syndicate for the purpose of combining the business. Among the firms represented are C. B. Rogers & Co, of Norwich, Ct. It is proposed to start with a cash capital of $30,000,000, and to have in reserve the additional sum of $250,000,000. These sums look suspiciously large.

Robert Poole & Son Co., Baltimore, Md., have issued the twelfth edition of their list of gearing pulleys, sheaves, etc. It is got up in a substantial manner, and will be an excellent addition to an engineer's or mechanic's library. Their list of gears is a large one, and their system of machine molding enables them to produce almost anything not in the list. They have facilities for cutting and planing teeth of gears up to fifty feet diameter.

A St. Louis (Mo.) dispatch says: A movement is in progress here which it is expected will result in a revolution in the manufacture of steel. The Brazelle Steel and Iron Company, of this city, have bought twenty acres of land in the suburbs, upon which they will erect immediately a plant of the capacity of 100 tons a day. They propose to manufacture pig iron at a saving of $4 a ton, and steel at a saving of $6 a ton, as compared with the cost of manufacture by any known method in use in the United States or Europe. The process employs a gas fuel derived from cheap coal or "slack," instead of employing coke.

Machinists' Supplies and Iron.

NEW YORK, April 15, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.25; No. 2, $13.50 to $14.25; Gray Forge, $12.75 to $13.50. Southern brands of good quality are obtainable at $14.25 to $14.75 for No. 1 Foundry; $13.25 to $14 for No. 2; and $12.25 to $13 for Gray Forge.

Antimony—The market is steady. We quote L. X., 10¼c. to 10½c.; Cookson's, 10½c. to 10¾c.; Hallett's, 10.10c. to 10.20c., and U. S. French Star, 10½c.

Copper—The market shows signs of improvement, but spot supplies are still obtainable at 11 c. for Lake Copper. Casting Copper is held at 10½c to 10¾c.

Lead—The market is firm. Sellers have advanced their price to 4.17½c. and 4 20c., which has checked the demand. The last sale was at 4.15c. by the carload.

Lard Oil—Prime City is at 83c. to 85c.

Spelter—The market is higher and firm at 4.32½c. to 4.35c. Buyers took advantage of the stronger position by having important orders filled at 4.30c.

Tin—The tendency of the market is toward higher prices; 20.85c. to 20.90c. have been realized for 100 tons April delivery.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Salesmen on commission, to push a special line of mach'y. "Kirk," care of AM MACH.

Junior draftsman, 2 years' experience, good detailer and tracer, wants pos. Box 92, AM. MACH.

1st-class designer of pumps, cranes & gen. mach'y is open for engage't. Except'l refs. Pumps, AM. M.

Good draftsman, designer, grad. Polyt'c, in Germany, desires change present pos Box 94, AM. MACH.

Mech. eng., exp'd in steam & gen. mach'y, desires engage't as ass't supt or m'g'r. Box 95, AM. MACH.

Wanted—Second-hand boiler plate shear; state price. Pattin, Hall & Pattin, Marietta, O.

1st class mechanical draftsman, good designer & practical mech. wants pos. Box 96, AM. MACH.

Wanted—Pattern makers on heavy machinery work. None but 1st class workmen of good habits need apply. Farrel F'd'y & Mach. Co., Ansonia, Ct.

Bradley Hammers.

If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a BRADLEY HAMMER will soon pay for itself, by what it will save over any other similar tool. Send for circulars.

BRADLEY & COMPANY, SYRACUSE, N. Y.

Draftsman Wanted—Experienced in saw-mill, flour-mill, special and gen. machinery. State age, exp. and salary. Novelty Iron Wks., Dubuque, Ia.

Wanted—An exp'd mech. draftsman for temporary work. State age, exp. and salary wanted. The P. H. & F. M. Roots Co., Connersville, Ind.

Brass Finisher Wanted—Must be a steady man, and one who does not use liquor. Illinois Malleable Iron Co., 581 Diversey Ave., Chicago, Ill.

Wanted—Position as superintendent or foreman of shop, general engineering business; 10 years' experience; references A1. Box 97, Am. Mach.

Foreman desires change July 1. Experience covers machine tools, pumping machinery, Corliss and high-speed engines, general jobbing and mill work, age 33. Box 84, American Machinist.

A practical man in mach. shop and foundry, can mix iron on analysis, wants position as supt.; can give best of refs., will guarantee to save salary on the mixture of iron alone. Box 79, Am. Mach.

Wanted—A mechanical engineer, a graduate who has had some shop exp.; also 2 mechanical draftsmen exp'd in general engine and machine work. F. W. E., Room 40, Coal Exchange, Scranton, Pa.

Foreman Wanted—Who can rub men the right way to increase production and do good work. One familiar with high grade engines desired. H. G., P. O. Box 1001, N. Y.

Draftsman Wanted—To grow into responsible place in drafting room. Mod. price to start. Worcester tech. graduate preferred. Address, giving exp., and wages expected, Box 93, Am. Machinist

A Situation Wanted—As foreman boiler maker, 10 years' exp., 6 years in one of the largest shops in the west, accustomed to all classes of work. Abilities A1. Alex. C. Forbes, 74 Canal St., Rochester, N.Y.

A mech. engineer of experience as supt., designing, estimating on work, management of men, etc. desires to invest a few thousand for partnership in a good concern. Address A., Am. Machinist.

Foreman in iron foundry, one familiar with all kinds of light and heavy machinery in green dry sand and loam; best of references from last employer. Address C., American Machinist.

Wanted—Tool-maker, steady, 34, used to turret lathes, universal milling and grinding machinery. Gear rack and worm wheels and cutters of all kinds, erection and repairs. Address C. N. Y., care American Machinist.

Wanted—Two experienced draftsmen on high-speed engine work. State ages, experience, ref., salary expected, and how soon can come. Address Stearns Manufacturing Co., Erie, Pa.

Wanted—A live man with good address, experienced in general steam plant work, to represent an old established business in and about New York. A good opening for the right man. State age, experience and remuneration expected. Mechanical Engineering, American Machinist.

Wanted—First-class Corliss engine general salesman of character and repute competent technically and practically to estimate on any power plant, and willing to live and travel anywhere west. Address, giving experience, reference and salary expected, T. E. G., American Machinist.

Wanted—One good man to erect machinery after built (outside man), and some good general machinists for shop work. Our specialties are coal mine haulage engines and mine ventilating fans; shop located in Pennsylvania. Address Box 200, American Machinist.

Wanted—Foreman for job foundry, employing about 30 molders. Must have experience on general work and be capable of running a foundry economically in all its details. None but a first-class man with good recommendations need apply. State age, experience and salary. P., 160 Clinton St., Milwaukee, Wis.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

(*Continued on page 12.*)

Ready-made Gears.
Gears Made to Order.
Gear Cutting.
Gear Book, 15 Cents.
Geo. B. Grant,
Lexington, Mass.,
And 125 So. 11th St.,
Philadelphia, Pa.

BRASS-WORKING TOOLS,

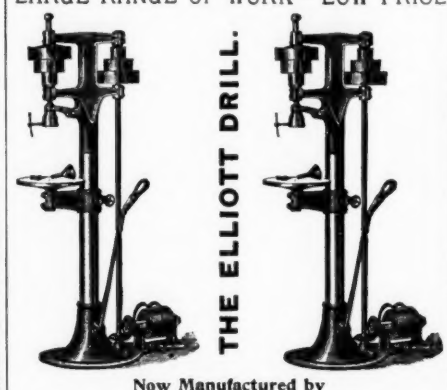
SPECIAL MACHINERY.

BARDONS & OLIVER Cleveland, Ohio.

PRICES on APPLICATION

SCREW MACHINES.

The Elliott Drill Press
FOR ANY LIGHT WORK
LARGE RANGE OF WORK - LOW PRICE



THE ELLIOTT DRILL.

Now Manufactured by
A. J. WILKINSON & CO.,
180 to 188 WASHINGTON ST., BOSTON, MASS.
SEND FOR CATALOGUE.

HACKNEY HAMMERS

Meet all requirements more fully and satisfactorily than any other of its competitors.

INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.

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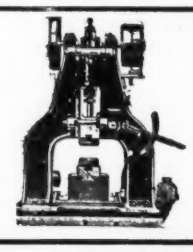

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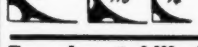

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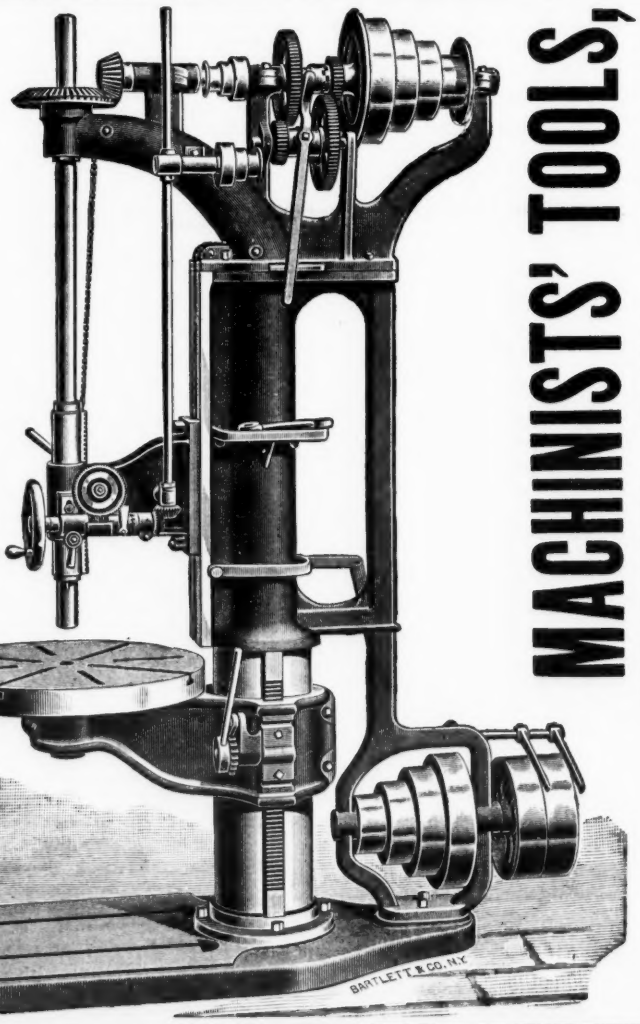

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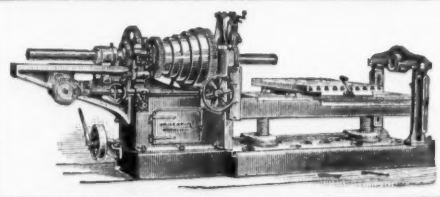

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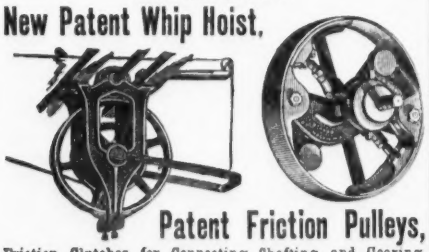

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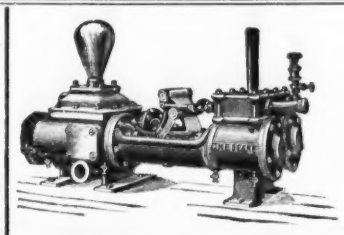

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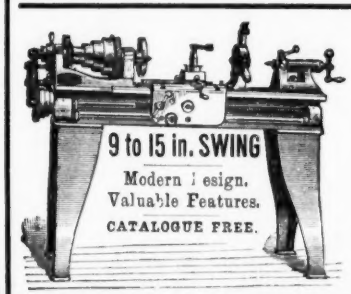

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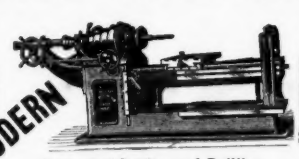

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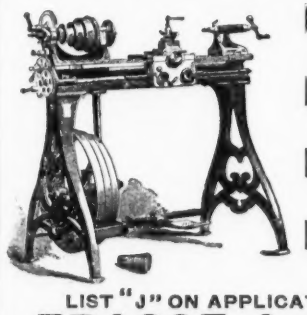

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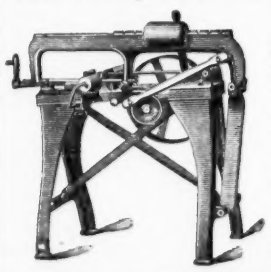

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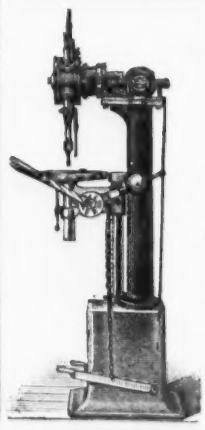

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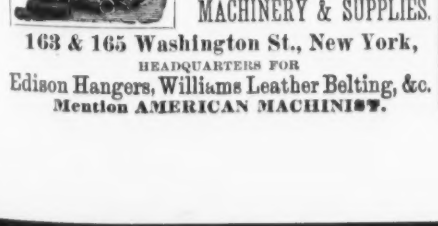

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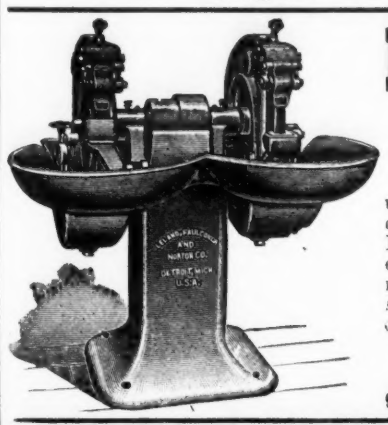

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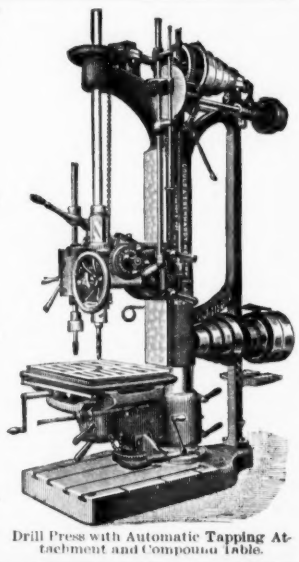

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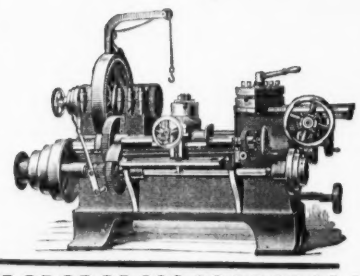

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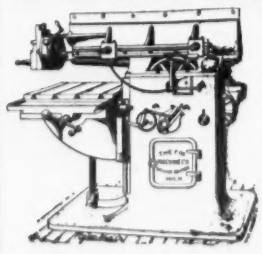

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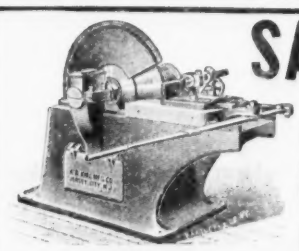

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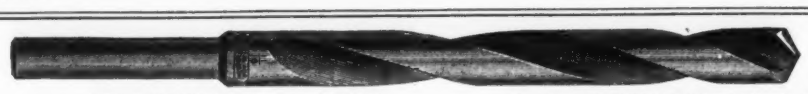

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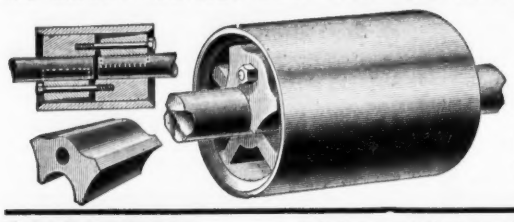

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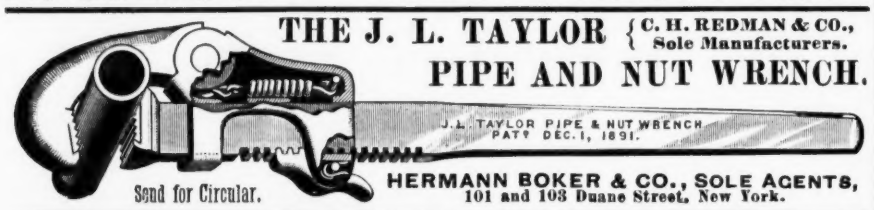

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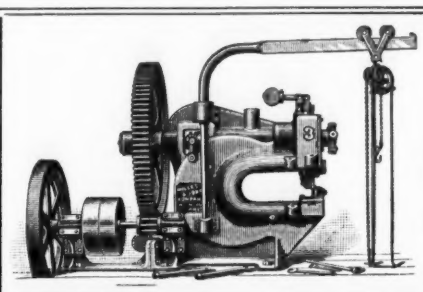

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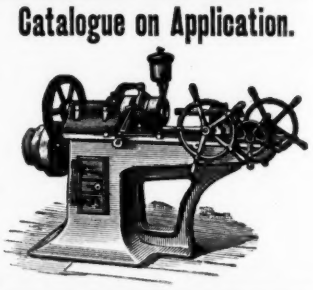

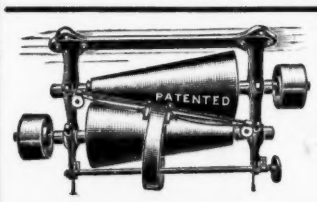

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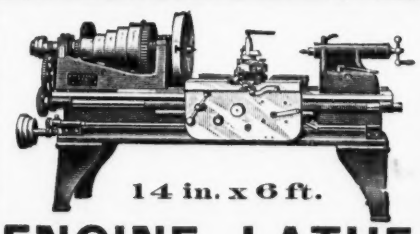

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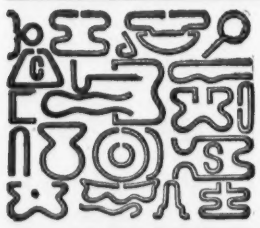

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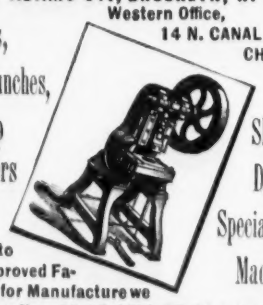

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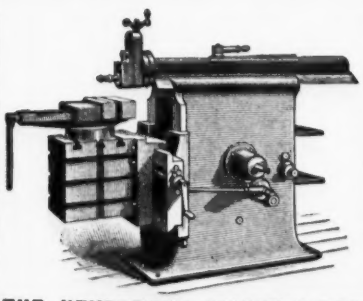

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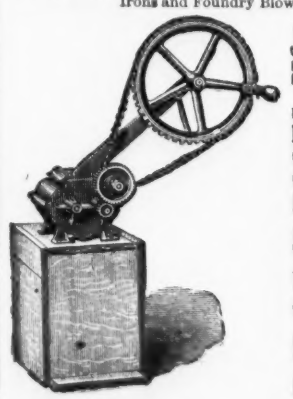

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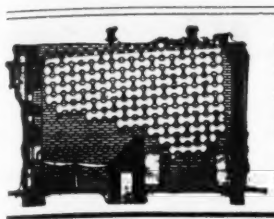

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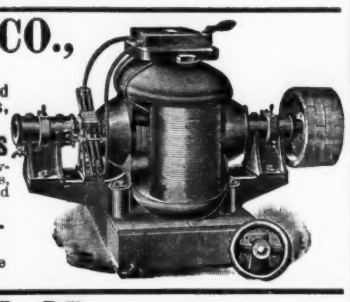

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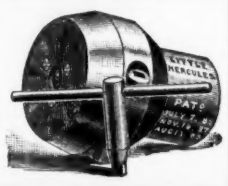

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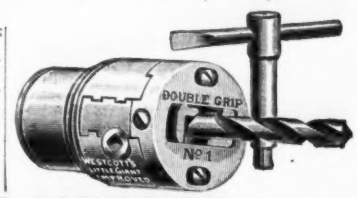

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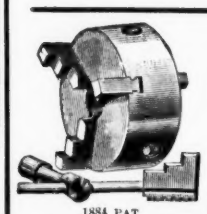
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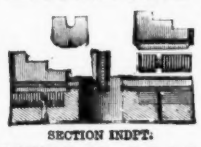
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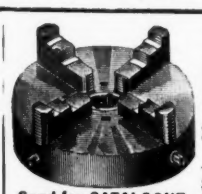

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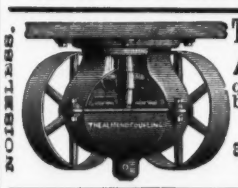

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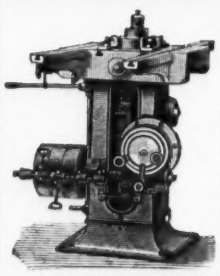

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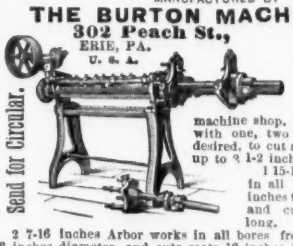

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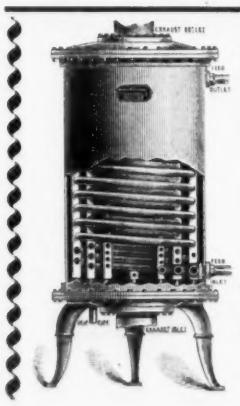

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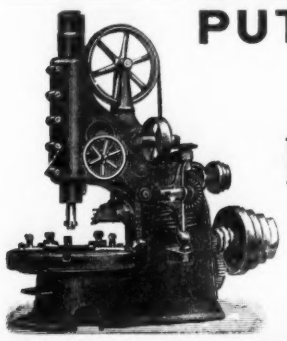

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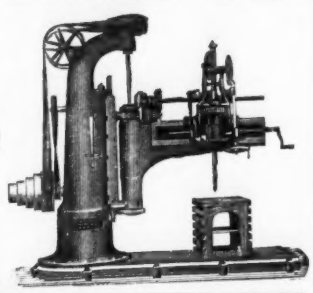

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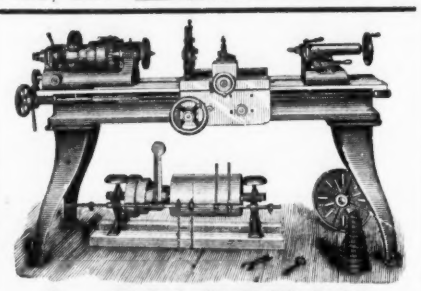

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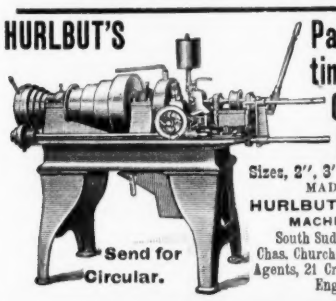

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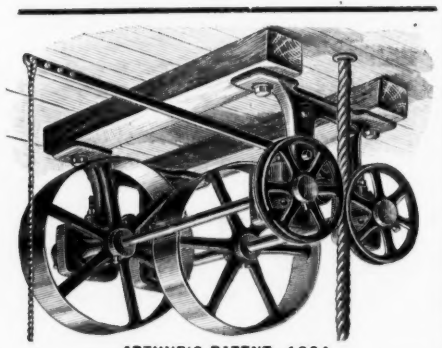

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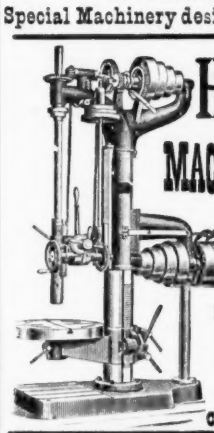

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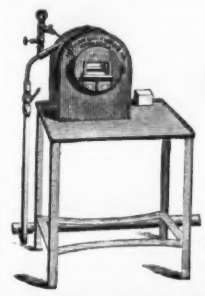

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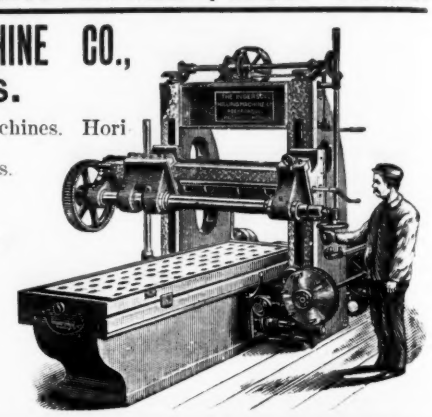

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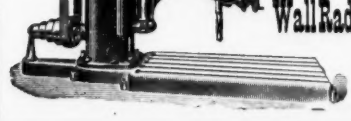

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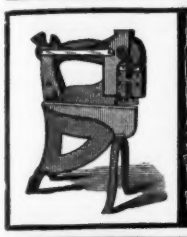

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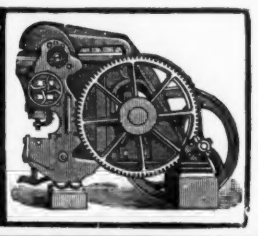

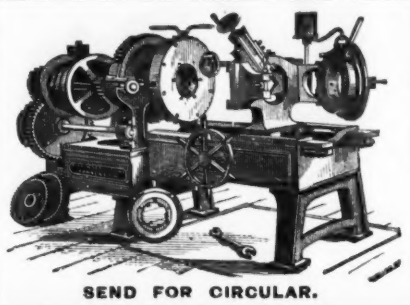

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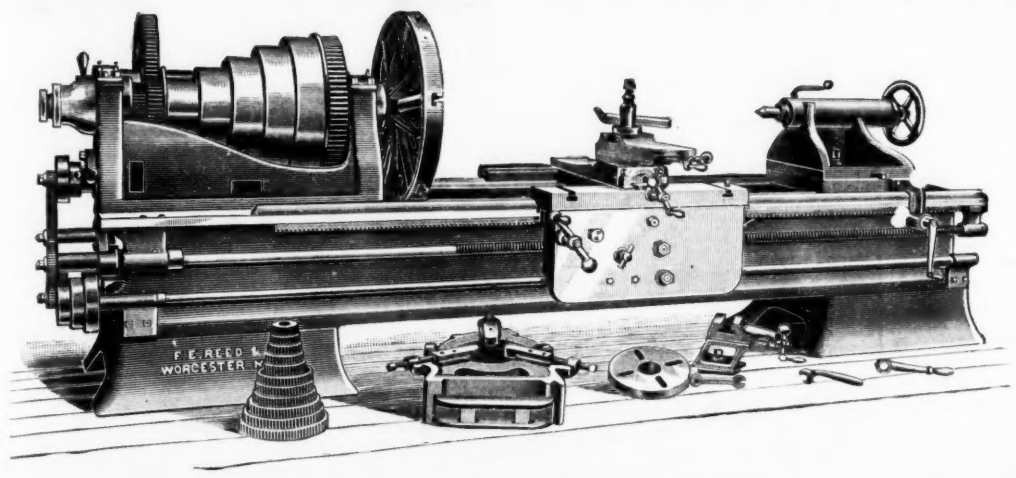

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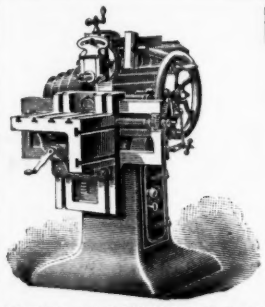

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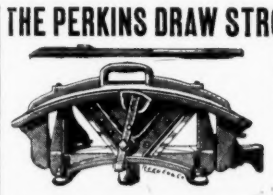

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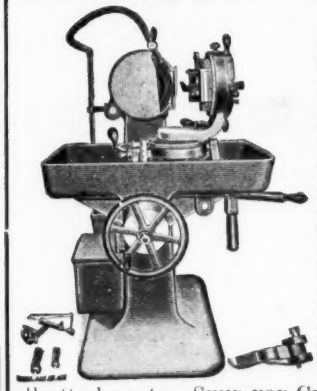

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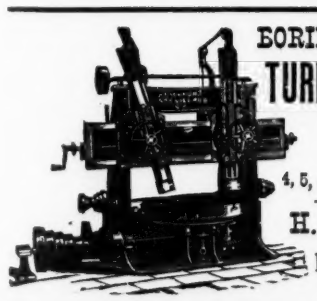

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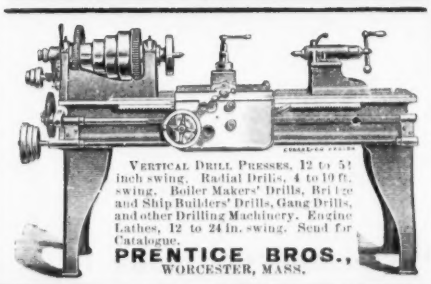

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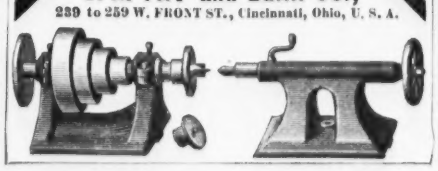

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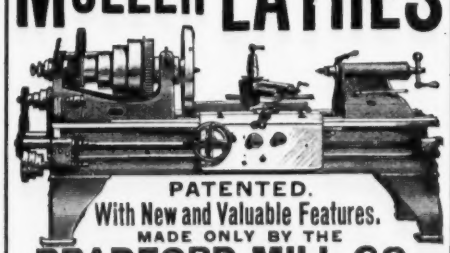

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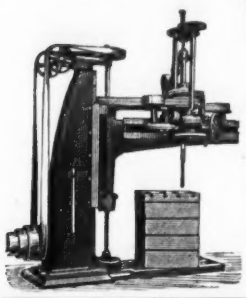

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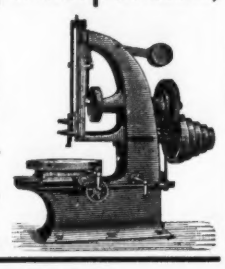

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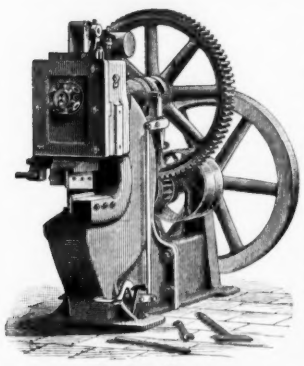

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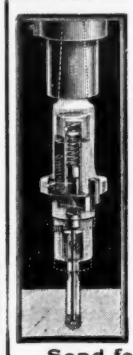

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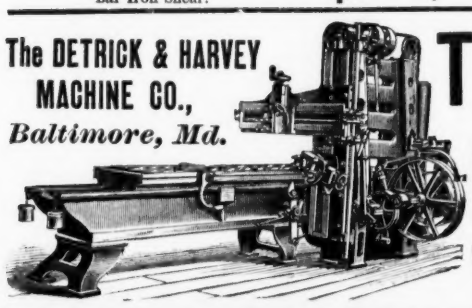

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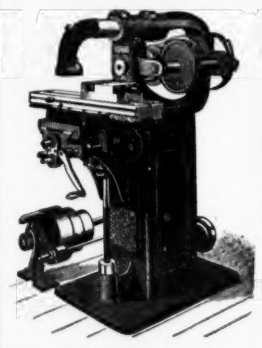

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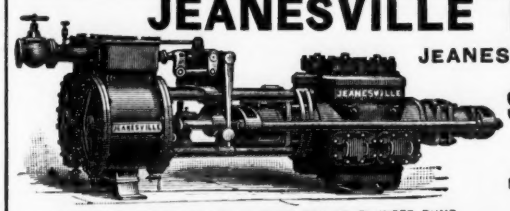

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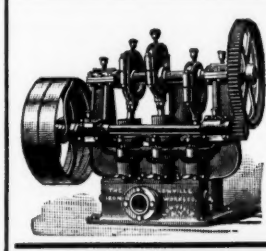

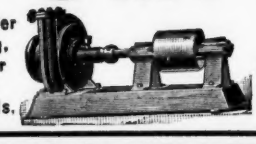

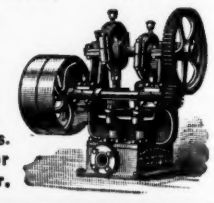

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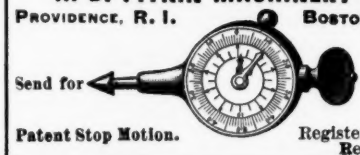

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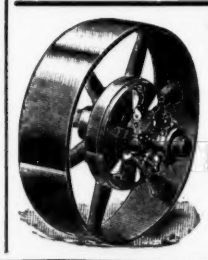

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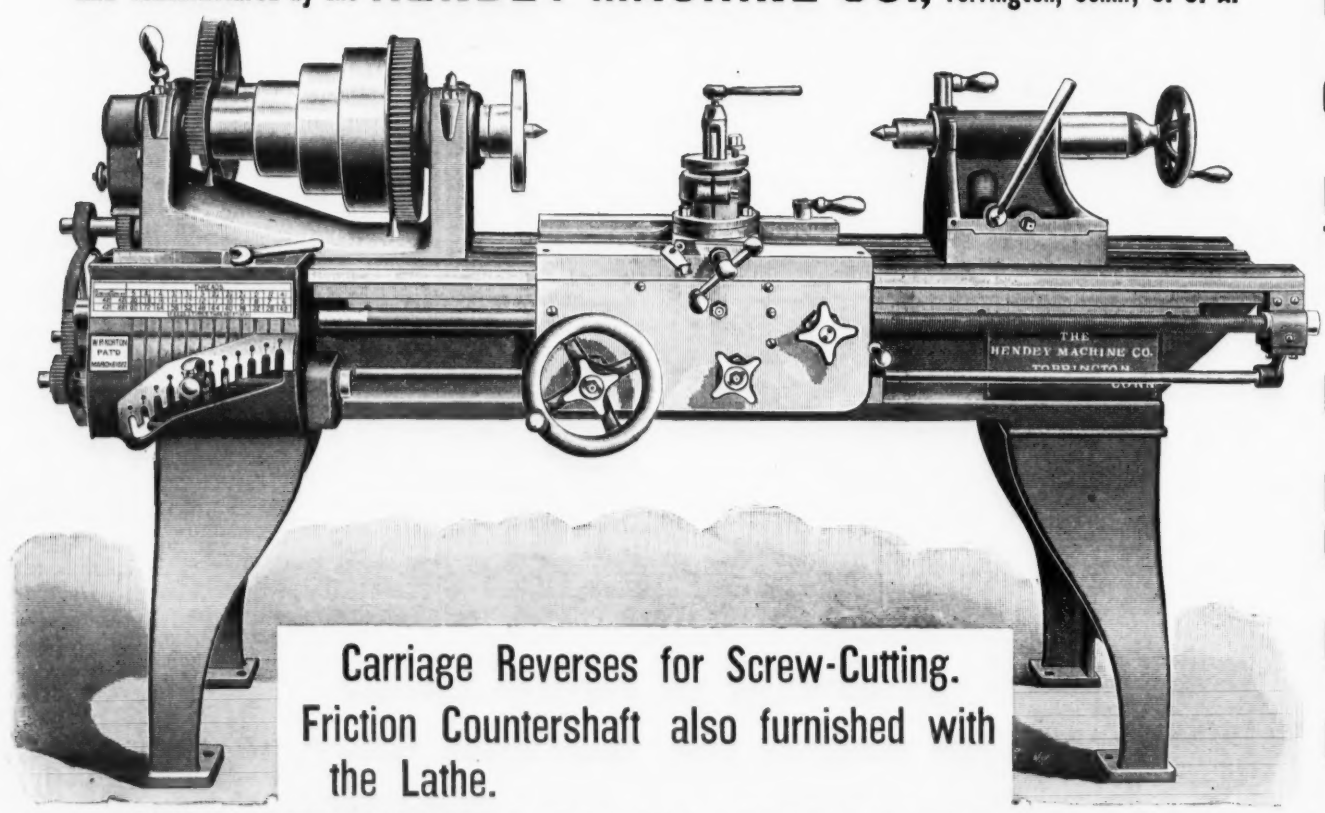

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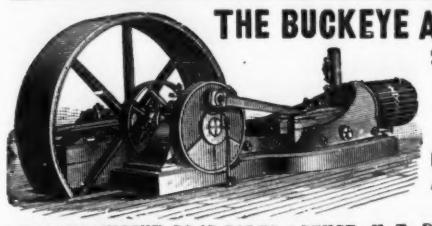

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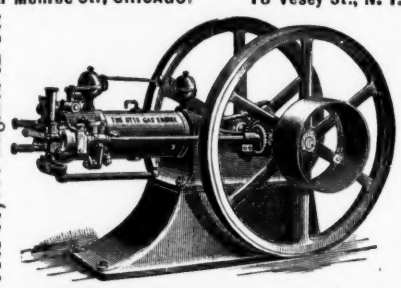

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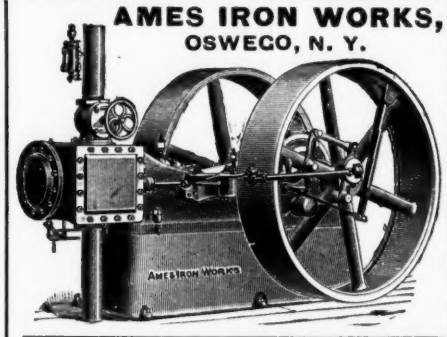

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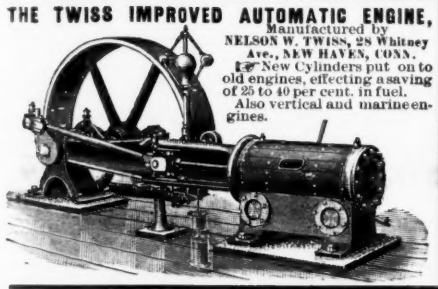

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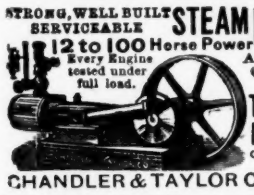

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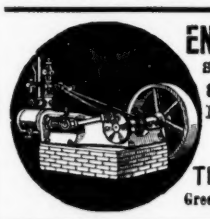

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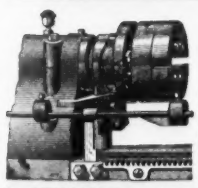

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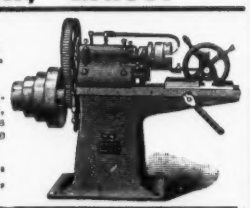

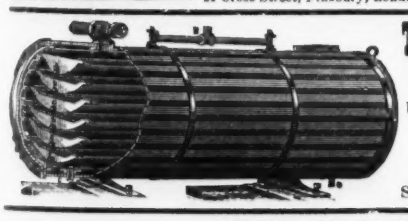

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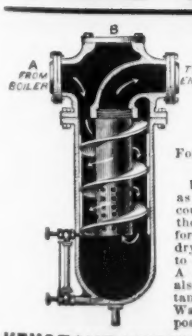

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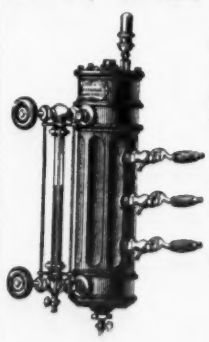

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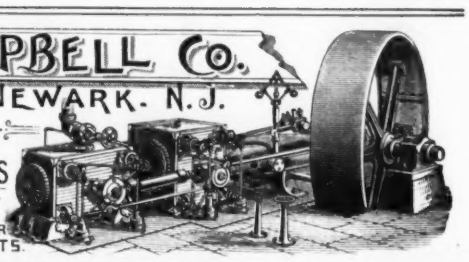

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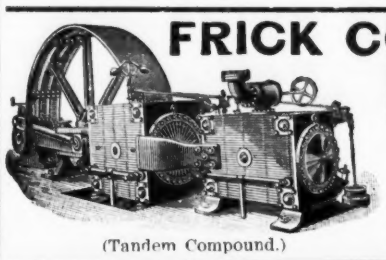

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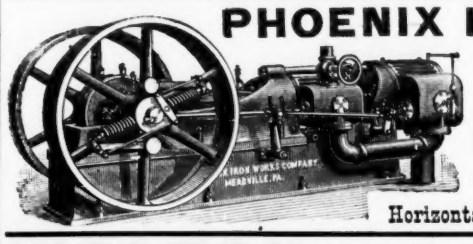

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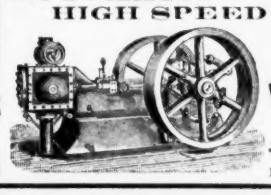

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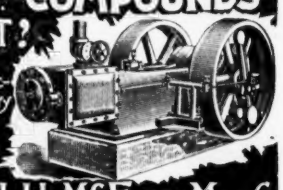

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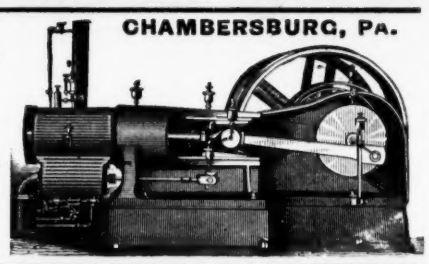

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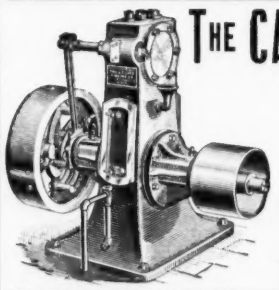

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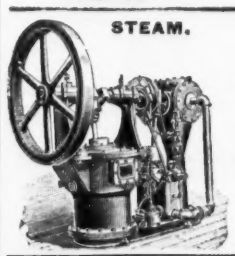

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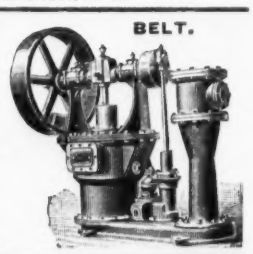

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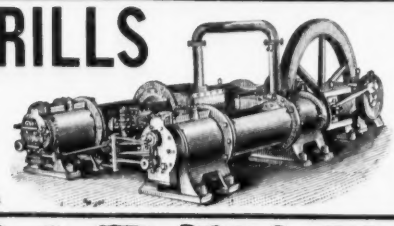

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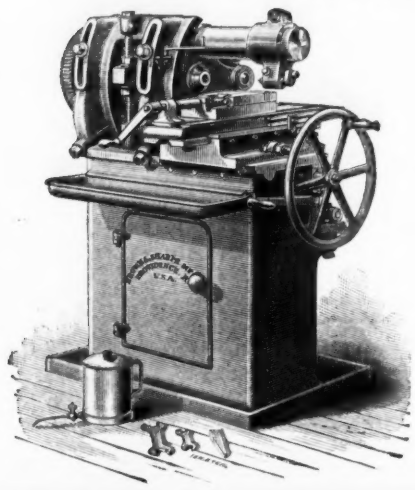

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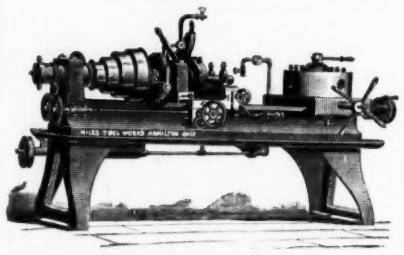

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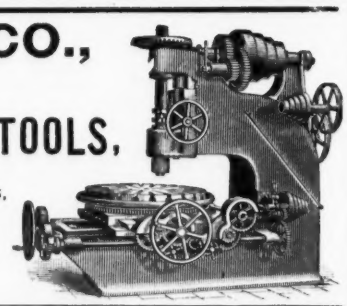

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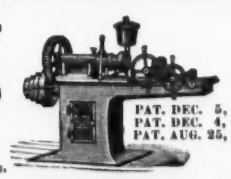

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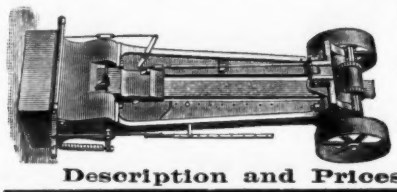

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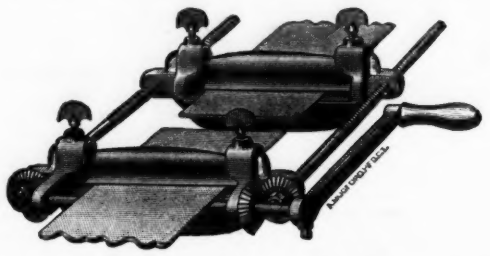

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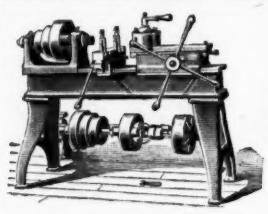

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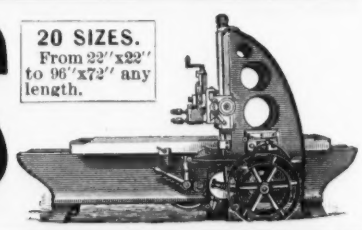

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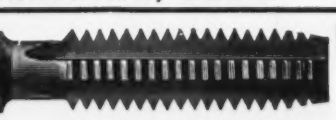

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